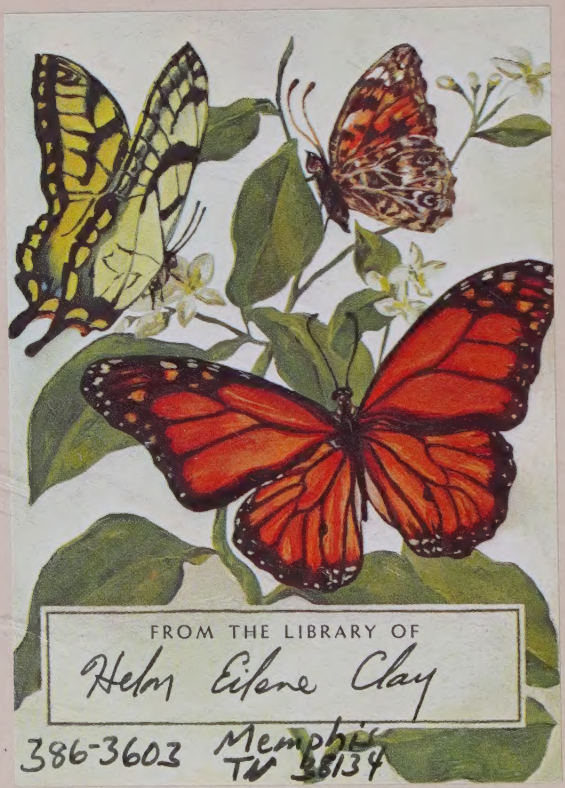
THE EXPERT WOOD FINISHER

A. ASHMUN KELLY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THE EXPERT WOOD FINISHER

A Text Book for the Guidance of the Expert Workman and Manual of Instruction for the Learner

THIRD EDITION

ENTIRELY RE-WRITTEN AND BROUGHT DOWN TO DATE, WITH MUCH NEW MATTER AND THE ELIMINATION OF OLD, MAKING THE WORK A THOROUGHLY RELIABLE SOURCE OF PRACTICAL INFORMATION FOR THE WOOD FINISHING TRADES.

BY

A. ASHMUN KELLY

Author and Publisher of the EXPERT SERIES of Books for House and Sign Painters, Paper Hangers, Interior Decorators, Calciminers, and Wood Finishers.

A. ASHMUN KELLY
1921

Reade Publishing Co.
296 BROADWAY
NEW YORK, N. Y.

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TABLE OF CONTENTS

PAGE

DESCRIPTION OF THE WOODS USED 1

Oak, Mahogany, Walnut, Maple, Red Gum, Birch, Beech, Redwood, Cypress, Hard Pine, Sycamore, Ash, Rosewood, Cherry, Chestnut.

WOOD FILLING 16

Close-Grained and Open-Grained Woods Listed and Described—Filling Open-Grain Woods—List of Paste Fillers—Table of Colors Used in Paste Fillers—Fillers for the Various Woods—Some Paste Filler Notes—Liquid Filler Notes—Some Liquid Filler Formulas—Filling and Finishing the Various Woods—Etc.

FINISHING WESTERN WOODS 62

FINISHING HARDWOOD FLOORS 67

General Description—Wax Finish—Varnish Finish—Finish for Hard Pine Floor—Finishing Hardwood Floors—Wax Floor Polish Formula—Polishing Hardwood Floors—Waxing Old Floors—Floor Wax Formulas—Floor Waxing Notes—Crack Fillers and Floor Putties—Cracks in New Floors—Large Floor Cracks—Putties and Cements for Hardwoods—Renovating Old Floors—A Few Minor Floor Notes—Douglass Fir Floor Finishing.

FINISHING VENEERED WORK 82

Preparing Mahogany Veneered Surface—Dyeing Veneers Black—Mahogany Veneer and Birch—Birch and Walnut Veneer—Finishing Walnut Veneer—Lines of Butt Joints do not Match—Staining Veneered Work—Polishing Veneered Work—Protecting Inlay or Marquetry—Penetrating Ebony Stain—Veneer Finishing Notes.

WOOD STAINS AND WOOD STAINING 90

General Description of Processes—Staining Oak—To

PAGE

Match Brown Oak—Weathered Oak—Bog Oak—Mission Oak—Flemish Oak—Light and Dark—Golden Oak—Antwerp Oak—Gray Oak—Dark Oak Stains—Antique Oak—Silver-Gray Effects—Trouble in Oak Finishing—Oak Stain Formulas—Stains Various—Etc.

STAINING WICKERWARE AND WILLOW FURNITURE 112

THE EQUIVALENTS OF WATER COLORS IN ANILINE DYES 117

DESCRIPTION OF STAINS AND THEIR USES . . . 118

THE ART OF WOOD POLISHING 128

French Polishing—Oil Polishing—Polish-on-Varnish Finish—Polish Formulas—Polishing in the Lathe—Various Polish Formulas.

FINISHING NEW FURNITURE 145

The Gloss Finish—The Rubbed Finish—The Polished Finish—Finishing Cheap New Furniture—Furniture Varnishes—Making Antique Furniture.

REFINISHING OLD FURNITURE 152

Description of Finishing—Enameled Furniture—Repolishing—Coloring Up—Furniture Polishes—Doing-Up Old Furniture—Furniture Cream or French Repolisher—Furniture Revivers—Furniture Renovating Polish—Derby Cream—Wax Stained for Colored Woods—Polish for Good Furniture—Renovating Piano Polish—Cheap Wax Polish—Polish for Statuary, Etc.—Perfuming Polishes and Renovators—Various Furniture Polishes—Removing Stains, White Spots, Etc.——Removing Old Varnish—Varnish Remover Formulas—Notes on Varnish Removers.

PRACTICAL NOTES ON VARNISHING 179

How Varnish Dries—Temperature of Varnishing Room—Why Varnish Cracks—Cloudy Shellac Varnish—How to Varnish—Varnish Turns Green—Heavy Bodied Varnish—Varnish Does Not Flow Freely—Difference between Exterior and Interior Varnish—Composition of Spar Varnish—Composition of Interior Varnish—Composition of Floor Varnish—How Varnish is Made—China Wood Oil.

PAGE

DESCRIPTION OF VARNISHES USED 186

Making Oil Varnishes—Short and Long Oil Varnish—Some Varnish Notes—Aged vs. New Varnish—Effects of Temperature—Characteristics of Good Varnish—Heat-Resisting Varnishes—How Many Coats of Varnish?—Flatting Varnish—Practical Varnish Notes.

VARNISH ILLS—CAUSE AND CURE 198

Blistering—Blooming—Brush Marks—Blotching—Bubbling—Brittleness—Chilling—Crimping—Creeping or Crawling—Chipping—Checking—Silking—Sinking In—Sweating—Seedy Varnish—Sandy Appearance—Sagging—Sissing or Cissing—Tears—Turning White—Wrinkling—Pitting or Pinholing—Flatting—Loss of Brilliancy—Skinning Over of Varnish.

SHELLAC VARNISH 203

Origin and Gathering of Lac—The Various Grades—Pure Shellac—Adulteration of Shellac—Bleached White Shellac—Orange Shellac—Preparing Shellac Varnish—Artificial Shellac—Water Shellac—Clear Alcoholic Solution of Shellac—White Gum Shellac Specifications—Special Quick Drying Shellac—Applying Shellac in Damp Weather—Chinese Glue—Shellac Varnish Notes.

HOW TO USE THE AIR-SPRAY MACHINE . . . 224

INFORMATION—GENERAL AND SPECIAL 231

Sap and Seasoning—Staining the Ends of Boards—Shop Economies—Staining Wood before Working Up—Imitating Old Mahogany—Mahoganizing Other Woods—Finishing Fireproofed Wood—Staining and Finishing House Trim—Violin Varnishing—Piano Finishing—Finishing Antique Oak Piano Case—Another Piano Finishing Process—Finishing a Rosewood Case—Mechanical Varnishing—How to Prevent Cracking of Varnish—Trouble with Shellac Finish—Imitation of Woods by Printing—Wood Finishes in Favor—Columbian Mahogany—Filling Checks in Veneers—Why the Varnish Sweats—Making and Using the Tacky Rag—Ebonizing Piano Keys—Polish for Ebony—Removing Dust before Varnishing—Staining Brown Mahogany—Perfume for Renovators, Etc.—Hardening Varnish for Table Tops—Solubility of Varnish Gums—Covering Capacity of Varnish—Finishing Laboratory Table Top—French Artificial Wax—Chamois or Goat Skin—

PAGE

Concerning Sponges—Testing Turpentine—China Wood Oil—Finishers' Supplies Described—The Waxes—Testing Varnish—Preventing Filler from Cracking—Baking Varnish on Wood—Crackle Finish—Finishing Mahoganized Birch—Finishing Birch Veneers—Oxalic Acid Preparation—Non-Cracking Linseed Oil—Figureless Quartered Oak—High Polish on Red Cedar—Finishing Birdseye Maple—Wax Finishing Small Articles—Finishing Ouija Boards—Oiled Sandpaper—Rubbed vs. Varnished Surfaces—Birdseye Maple—Polished End Wood—All-Around Varnish—Making Brown Mahogany—Humidity in Finishing Room—Toning Down Circassian—Staining Mahogany—Finishing Inside of Case Goods—The Curly Woods—How Sandpaper Is Made—How to Use Sandpaper.

VARNISH STAINS 277

How Prepared—Stained Filler—Walnut Varnish Stain—Oak Varnish Stain—Cherry Varnish Stain—Ebony Varnish Stain—Satinwood Varnish Stain—Note.

THE EXPERT WOOD FINISHER

DESCRIPTION OF THE WOODS USED

THE process of wood finishing is one of the simplest of the mechanical arts, and yet it demands of the workman a degree of skill not exceeded in any other line of handicrafts. The first requirement is a knowledge of woods, their physical structure, so that the treatment necessary to their perfect development of line and color may be understood. Then comes material and manipulation thereof, the staining and filling of the woods, and the final work of varnishing, rubbing, polishing, etc. Nor is this all, for the finisher must understand the composition and nature of the various stains and pigments he handles, the aniline dyes, the liquids, the mineral and vegetable pigments. While all these matters are fully and carefully described in this work, yet it will require experience in order to develop the complete workman. Study the instructions given here, and follow them carefully, and in due course you will succeed in mastering the art and becoming a skilled wood-finisher,—if you put heart into your work, for unless one loves his work he never can succeed in becoming its master.

I shall first take up the subject of woods. We try to place the woods under two heads, hard and soft, but these are not the most appropriate terms to use, and they are confusing to most of us. There are, botanically, two broad groups of tree species, the deciduous or broad-leaved tree, and the evergreen, needle-leaved or coniferous trees. The wood of the most of

the former is comparatively hard, and that of the latter mostly soft. The names, hard wood and soft wood, have, therefore, been applied to the two groups, respectively. But they are not the best descriptive terms, because such woods as basswood, yellow poplar, and cottonwood, known under the above classification as hard woods, are quite soft; while such woods as the Southern yellow pines, which are in our soft wood class, are rather hard. Under the head of Wood Filling I have listed two groups of woods under the heads of close-grained and open-grained, which for our purpose is a better classification than that of hard and soft woods. For it is with the matter of grain that we are the most concerned, as it makes very little difference whether a wood is hard or soft, when we have the other list to guide us. Under those heads we find listed sixteen close-grained woods, and eleven open-grained woods. Showing twenty-seven different kinds of wood used in cabinet and house construction work that are treated by the wood finisher.

The finishing of these woods is fully described under appropriate heads, and requires no further description here. Each wood is taken up and its treatment painstakingly described. And as the reader proceeds he finds all necessary information touching the nature and uses of the different materials that enter into the work on finishing.

We will now take up the various woods and describe their characteristics, with some account of their life history. First in importance come the oaks.

Oak.—The forester places all the oaks, of which there are many different kinds, in two classes, naming them white and black. The woods of the two groups are structurally different. Of the some seventeen listed in a bulletin issued by the Government only a few interest the wood-worker and finisher. These are the

white and the red oaks. True, there are some few others that enter into furniture making and into house trim, but for fuming and staining, only the white and red oaks are desirable. Red oak has several other names, such as mountain oak, black oak, and Spanish oak, it being a member of the black oak group. It is more abundant than white oak, and grows faster, but is considered inferior to the white oak.

Of the white oak group those most used, outside of true white oak, are burr oak, chestnut oak, post oak, etc. Of the black oak group the most used are Texas red oak, red oak, and spotted or water oak. The best quality of white oak is largely cut into quarter-sawed boards, while a combination of one or more white oaks and red oak may constitute cuts of "white oak." In many markets the term "cabinet white oak" is understood to include a mixture of red and white oaks, but not infrequently it means simply red oak. However, for all the purposes for which white oak is commonly used, practically all the trees of this group will yield woods that can be interchanged and will serve equally well.

It is probable that all the various oaks give what is called the "splash line" figure upon being quartered, and no other wood does this. While at this writing the beautiful splash or flake effects seen in quartered oak are taboo, having been overdone the past few years (the practice of quartering oak having originated about 1871 or 1872), still when properly finished there is nothing finer in the wood finishing line. At first only white oak was used for quartering, but before long it was discovered that other members of the white oak group possessed fine flake effects, though some excelled others in this respect. Then it was a little later on found that some members of the red group gave fine figure effects.

The largest member of the white oak family is the burr or overcup oak. Some in the Missouri River bottoms have measured as much as from five to seven feet in diameter. In some cases the wood is found to be too coarse to finish well, and also that the color contrast between the splash line and the wood itself is insufficient. Yet there are those who claim for the wood that no other member of the oak family presents so beautiful a figure.

As for the red oaks, some of them give a figure so closely resembling white oak that it is not easy to distinguish the difference, if any exists. In some cases both the figure and wood resemble white oak very closely. At other times red oak wood takes on a pinkish hue that adds materially to its beauty.

MAHOGANY.—Less than one-half of the mahogany used in the United States is the true mahogany *(Swietenia mahogani)*. This tree is confined naturally to the western hemisphere, where its range of growth is comparatively restricted. All other woods known in the trade are spurious. It is true that there are other important groups of mahogany-like woods within the mahogany family *(Meliaceæ)*, but they are not entitled to the name mahogany. As justly call dogwood tupelo gum because the two are botanically related.

Besides the genus *Swietenia* there are a number of other genera of trees in the mahogany family which are used as mahogany. These are confined chiefly to West Africa, and the woods after reaching the market are known as African mahogany. There are also a number of different species sold as mahogany that do not belong to the mahogany family at all. There are perhaps twenty-five trees on the west coast of Africa that sell under the trade name of "mahogany."

The principal species from the African coast belong-

ing to the mahogany family is Gambia mahogany; this formerly furnished most of the African mahogany. A magnificent tree, the wood closely resembles true mahogany in color and figure, but is of a deeper reddish-brown color. The pith rays are farther apart than in true mahogany and are not arranged in tiers, which can be seen to best advantage on what the millman calls a bastard cut surface. This wood is hard and heavy, and is more difficult to work than true mahogany.

Another tree, closely related to the Gambia mahogany, found from Liberia to the Gold Coast, furnishes a great deal of so-called African mahogany. There occur in this region two other trees that furnish an African mahogany under the name of "Tiami." Briefly, the woods similar to mahogany are very numerous in Africa, one region comprising 52,000 square miles of dense forests of such woods.

There are two kinds of fancy mahogany, streaked and figured. The one has irregular wavy lines in the longitudinal section, and the other is irregularly figured or mottled, which adds richness to the wood. The figured and streaked mahoganies are very rare, and only from one to three are found in a hundred trees felled. It is said that when the African mahogany is quarter-sawed it always shows the ribbon or streaked figure, with occasional mottlings.

The rich color and handsome figure of true African mahogany, and its uniformity of texture and color, easily places it at the head of the mahogany varieties. Yet it also has its weak points. It is comparatively soft and porous, and is lacking in the strength that other mahoganies have. Its open grain tends to develop the fuzz that is such a bother to finishers. And it occasionally develops cross-breaks, due to wind stresses, probably, which is against it where strength

counts. But for veneers it hardly is equaled. As for it being the only true mahogany, remember that this is spoken from the botanist's standpoint. There is some difference between the botanical special of *Mahogani Sweitenia, Cedrela* and *Khaya,* as well as some difference of microscopic nature in their cellular structure, but the difference does not materially affect the woods in regard to the uses they are put to. Yet experts can distinguish the characteristics of all the woods of this family, from Africa, South America, the West Indies and Mexico. The West Indian wood is the hardest, the heaviest, and the darkest in color. It has a good figure, but is small in size. Cuban wood is small in size, and poor in color, being quite light. Its compact grain and great strength make it an excellent wood for chairs and frames, for which it is commonly used. In former times it was called Spanish mahogany. Mexican mahogany is unexcelled for firmness of grain and evenness of texture. Not as hard and dense as the West Indian, it is harder and more compact than the African.

Mahogany is an interlocking-grain wood; its fibers cross each other at an angle, or interlace. The degree of the angle at which they cross determines the development of the figure. When the direction of growth is nearly parallel to the tree's axis the wood presents a plain appearance, but when the growth is at a decided angle there is a strong development. African mahogany is of this interlocking growth kind, and very strongly so; hence its most common type of figure is a stripe, which occurs in various degrees of strength. But in addition it has mottle, fiddle-back and curl, in combinations, presenting a great variety of figures. Being a tree of great size it is particularly adapted for making veneers, and it is said that 90 per cent. of the mahogany veneer produced is cut from African

logs. It is somewhat softer than the American wood, and when fresh cut its color is pink.

Mexican mahogany is the best adapted for interior finish, because of its hardness, which enables it to stand hard usage better than the softer woods. And as just now furniture makers are favoring a brown finish for mahogany, and as the Mexican wood is light of color, it is easier to get a good brown effect than on the darker woods. It is also claimed that Mexican mahogany holds its color and figure better than any other variety of mahogany, and grows darker with age.

Concluding, it may be well to summarize the facts about the mahogany family as follows:

Mahogany is divided into three general groups, viz.: African.—It has the best figure, comes in large logs, has the darkest color; but it is soft, porous, and not especially strong. Mexican, Honduran and Nicaraguan.—Wide variety of markings, ranging from little or no figure to extreme markings; is hard and very strong; is lighter in color than African wood. West Indian.—Very hard, and excepting in cases of occasional San Domingo logs, does not develop figure; is light in color.

Mention should be made of Philippine mahogany, extensively used after the World War shut off foreign mahogany. There are several varieties, such as Almon, Tanguile, and red and white Lauan. White Lauan and Almon are the light-colored woods, while red Lauan and Tanguile are dark. They are all of the same general family, and when finished present the same general appearance, it being possible to stain the light woods to give the appearance of the dark mahogany color. Or they can be finished natural, to imitate primavera or white mahogany. The quarter-sawn wood shows a fine ribbon grain, and for this reason is preferred to woods which have been used as substitutes

for mahogany, but which show none of the mahogany characteristics of figure.

Philippine mahogany is used for interior finish, cabinet work, furniture, etc., the same as African mahogany. While not hard, yet it is sufficiently hard to take and hold a high polish, and when properly finished only an expert can tell it from the more familiar mahoganies from Africa.

Baywood is the name once given to the mahogany of the Bay Islands, Honduras. Even now one hears the name baywood given to true mahogany, and the term is confusing. Formerly the mahogany from Central America was known as baywood, while that from the West Indies was called Spanish mahogany. Fifty different woods are now sold under the name of mahogany. Spanish cedar is much used in place of, or masquerading as, mahogany. True baywood, the name given to a wood resembling mahogany, as well as to a wood resembling true mahogany, and now scarce, was a very poor substitute for mahogany, because it was soft and light, and had none of the fine markings of true mahogany, its grain being straight. Yet it had some of the color of mahogany and took stain well.

Circassian mahogany; a misnomer, for there is no such wood; instead, we have Circassian walnut, which see under head of Walnut.

Walnut.—The walnut is a tree of the genus *Juglans,* the members of this family of most importance to cabinet makers being the black walnut, the Persian or mis-called English walnut, and the white walnut, or butternut. Of the three the most popular is the American black walnut. The Persian walnut is excellent for furniture, etc., but the black walnut is much more favored. The butternut or white walnut also presents a fine wood for cabinet work. One of the best testimonials that black walnut has is the fact that no

other wood equals it for use in making gun stocks, for which purpose it is ideal. The wood is easily worked, and takes a very fine finish.

French walnut is distinguished by its fine burls, and is used in making veneers.

Circassian Walnut.—Because of a similarity in names Circassian walnut is often confused with Caucasian, but there seems to be quite a difference, the Caucasian lacking the figure of the Circassian wood, and being also a harder wood. Even in butternut there are sometimes found logs that are remarkably similar in appearance to Circassian. It seldom runs as near to black in its figuring, but when really well figured butternut is found we have about the nearest thing, outside of the real wood, to Circassian walnut.

Circassian, like other valuable cabinet woods, has its substitutes. Besides our red gum, there are other woods, from Africa, South America, and Asia. Many of these woods are walnuts, and among them and the related woods are Caucasian walnut, Japanese walnut, butternut, Jamaica or West Indian walnut, and nogal, a member of the *Juglans* family. Our red gum is used along with and as a substitute for Circassian walnut.

Maple.—The maple is of the genus *Acer,* all its species being confined to the north temperate zone, these species being eighty in number. The maple woods of interest to the woodworker and finisher are the hard or rock maple, or sugar maple, the white or silver maple, and the birdseye or curly maple. There is also an Oregon maple of great beauty when finished, it being light of color, with a surface covered with small waving lines, these showing handsomely at times, particularly in the glow of artificial light. Common hard maple has little beauty as regards figure, but its color and fine grain lend themselves to a very handsome finish. The grain of curly or birdseye maple varies as

the saw divides its eyes transversely or longitudinally, and pieces cut out in circular sweeps, such as chair backs, sometimes exhibit both the birdseye and the mottle at different parts. The occurrence of eyes, zones, spots, and small curls in the wood form figures of great beauty. The wood shows, in the finished work, the peculiar appearance of small dots or ridges, or of little conical projections, with a small hollow in the center, but without any resemblance of knots, the apparent cause of ornament in other woods of similar character, as the burrs of the yew and Russian maple, or birch. Once it was thought that these so-called eyes resulted from birds pecking at the bark, but Holtzappfel investigated the matter carefully and found that they were caused by little spines or points in the bark, the layers of wood being molded upon these points, and each of their fibers is abruptly curved at the respective places, and when cut through they give, in tangential slices, the appearance of projections, the same as some rose-engine patterns.

The white or silver maple also gives a very fine finish at the hands of the expert wood finisher. It is specially useful for stiles and rails for doors, surrounding birdseye panels.

When properly seasoned maple holds its shape well, and is a strong, hard and stiff wood.

Red Gum.—A very common tree in the South, growing to magnificent proportions in the best soils. Its heart shows a wide range of both color and figure. It is slightly darker than new-cut mahogany, and some of its parts are more elaborately figured than that wood. The color in general resembles that of mahogany. It is liable to warp and twist, but careful seasoning tends to reduce this to the minimum. Natural finish brings out its color and figure. The color is something like cherry, or rather more that than like

mahogany; its red color takes on a purple cast, very rich and soft. The grain of the wood is close, and it takes a very fine polish. Sometimes called satin wood.

Birch.—There are the sweet or black birch, the yellow or gray birch, the red birch, and the white or paper birch. The wood is close-grained and fine, and comes both straight and curly. Generally the wood runs straight, and while it is a heavy, hard wood, it is never tough or cross-grained. It is easily cleaned up and made ready for finishing. Usually it is stained, but mahogany color does not look well on it. White birch is generally finished natural; a dull finish is best for any birch.

The sap wood of yellow birch is yellowish, the heart wood light to dark reddish-brown. It is the heart wood of birch that furnishes the beautiful red birch, which rivals mahogany in beauty. Both sapwood and heart wood take a brilliant satiny polish. The figure of curly birch is especially handsome, while the sparkling luster of the finished wood gives a richness of tone such as is looked for only in the costliest imported woods.

Fine as this wood is, it is not without its weak points. It is difficult to finish natural, as it lacks uniformity of color and marking, and if stained it is apt to fade. On the other hand, it has strength and density far superior to gum and will hold its color better; stained with anything but aniline it will hold color as well as any wood. The woodworker says that the wood has an oil that is bad for the glue in the gluing of the joints. Excepting in the best grades of furniture he does not try to match the wood's figure very closely, so that in a glued-up job he can put the sap edges together and the heart edges together, which will ensure a good joint. Then the finisher can stain the light parts to match the dark, and follow with a light coat of stain to make all harmonize. And he may stain the filler, too.

Beech.—The red beech wood is very handsome, and when properly stained makes a very good imitation-cherry wood. It has a fine grain and is a very durable wood, and when quarter-sawed its beauty is further enhanced.

Redwood.—Found growing only in California, and there only in restricted sections, the homes of the famous "Big trees." There are two species, *Sequoia Gigantica,* or big tree, and *Semper Virens,* or ever-living tree. It is only from the latter that we get redwood for cabinet or house building wood. It is a very durable wood, with a hard heart and a soft body outside of that. It has a gummy sap that makes it difficult to paint, and oil stain is not the best for staining it, as it takes a long time for drying, even with plenty of driers. It contains no pitch. The wood has good color, and natural finish becomes it very handsomely.

Cypress.—This is a Southern tree, the *Taxodium Distichum* of the scientist; its leaves being narrow places it among the soft woods. Locally it is variously known as bald, black, white, red, and deciduous cypress. It is not as abundant as the pines, and in its uses and appearance it is not unlike white cedar. It is a very durable wood, has good color, is free from sap, and has straight grain; it is light and strong, and is extensively used in house building. It grows darker with age, but not unsightly, but rather rich; exposed to exterior influences it grows both dark and unsightly, though commonly coated with paint. One objection to it as a cabinet or house-trim wood is the rising of its grain under the influence of dampness; it should always be finished as soon as possible after being made ready for the finish.

Hard Pine.—The pine belongs to a large family of useful trees, the *Coniferæ.* It is not difficult to distinguish a pine from a spruce, fir, larch, cedar, etc.,

of the same family, and formerly included in the same genus, *Pinus*. The pine is easily known by its evergreen, needle-like and short or long leaves and its cones. Of the some seventy-six species known, twenty-six are found in the United States, among which the most common are the white pine, now nearing extinction, the long-leaf, Southern yellow, or Georgia pine, the loblolly and the red pine. Then there is the Douglass pine of the Pacific coast, and sometimes called the Oregon pine and Douglass spruce, a tree that sometimes reaches a height of 300 feet, with a diameter of 15 feet. The long-leaf pine, called also the Georgia pine, hard pine, yellow pine, and red pine, is one of the most important of the family in this country. It is a good building wood, and furnishes rosin, turpentine, etc. It is a very hard, strong, compact wood, yellow or reddish of color.

The long-leaved pine is called for distinction the Southern yellow pine, but the name yellow pine is applicable to any of various species of *Pinus,* but especially of the common yellow pine found east of the Rocky Mountains, and which is also known as spruce, bull pine, and, in contrast with the Southern pine, short-leaved pine. White pine is a term applied to any one of several species of *Pinus* having a white or whitish wood, and their leaves in clusters of five. The once common white pine of the United States and Canada has been the most valuable building lumber tree we have ever had. There are other kinds of white pine to take its place, but in color, texture, or grain, there is none equal to the old white pine. But there is a vast quantity of the other white pines.

Sycamore.—This is the American plane tree, but more commonly known as the sycamore or button-ball. It is one of several trees constituting the genus *Platanus*. It differs so much in appearance from any

other tree that it is one of the most easily recognized. Its wood is very dense, its markings beautiful, and it is further improved in the latter respect by quarter-sawing. It takes a handsome finish. Oregon sycamore resembles the birch of the Eastern states in its markings, having waving lines that run close together. It is a tough and strong wood, and well adapted for making veneers.

Ash.—There are several varieties of the ash, but the ash tree furnishing the most valuable timber of any is the white ash *(Frazinus Americana)* of the United States and Canada, a large forest tree having a light, tough, elastic, hard, close-grained wood, specially adapted for making agricultural implements, wagons, etc., no other wood serving as well the purposes mentioned.

The ash of the Eastern states has a close, even grain, while that of Oregon has peculiar figurings of concentric curves, taking a very fine polish. Ash is now used in connection with common oak, and passes as oak when stained and finished as such. Although the grain of the two woods is entirely different, yet with filling and staining ash looks very much like oak of a certain kind. It is often used for making cheap furniture, or used with oak in the same piece of furniture, to save the costlier oak. Hungarian ash has a beautiful burl, making fine panels and veneers. The English white ash is similar to the American and Canada white ash.

Rosewood.—A fragrant cabinet wood having a close grain, which is more or less variegated, and very hard and dark. It is a Brazilian tree, of the genus *Dalbergia*, the wood which we meet with being the *D. Nigra*, the most highly prized of the many members of the genus. It derives its name from the fact that when fresh the wood is rose-scented. There are inferior grades of

this family of trees, of other species, known as violet wood, kingwood, etc.

CHERRY.—This is one of the most valuable of all our native woods, bearing a valuable fruit, yielding a fine wood for cabinet work, and giving a good flame when used for firewood. It belongs to the genus *Prunus,* the two most useful cabinet woods being the wild black and the cultivated cherry. It has a close grain. Its natural color is fine, but it is usually stained mahogany color, giving an imitation mahogany finish excelled by no other wood.

CHESTNUT.—A member of the oak family, *Castanea vesca,* found growing in poor, stony soils in the eastern part of the United States, and not doing well in rich soils. It has a coarse grain and very open pore, requiring a heavy paste filler. Cheap furniture is made from chestnut, and the wood is filled and stained to imitate oak, though it is mostly finished natural in house trim. It has many good physical features, being easy to work, not inclined to warp or twist, and not affected by dampness; but its coarse grain and very coarse heart-growths make it undesirable for cabinet work. Since the advent a few years ago of an imported fungus disease that attacked the tree there is very little left alive at this writing.

WOOD FILLING

The woods used in constructing furniture and house trim, and in fine cabinet work, etc., may be placed in two groups, hard and soft woods, or open-grain and close-grain. The latter is perhaps the best classification, for there are some woods whose texture is hard, while its grain may be open or close. Maple, for instance, has a very close grain, but it is a hard wood. White pine has a close grain, and it is a soft wood. The following lists show the woods as generally considered by wood finishers.

Close-Grained	Open-Grained
Birch	Ash
Bass	Beech
Cedar	Butternut
Cypress	Baywood
Gum	Chestnut
Maple	Elm
Oregon Pine	Mahogany
Poplar	Oak
Spruce	Pitch Pine
Satinwood	Rosewood
Sycamore	Walnut
Tamarach	
White Pine	
Washington Fir	
Yellow Pine	
Redwood	

Filling Open-Grain Woods.—Where the grain is open enough to require filling, in order to provide a solid foundation for the several coatings of varnish a paste filler must be used. This filler is made rather stiff, but is thinned more or less, according to the nature of the wood, before using. The solids of the

filler fill up the pores, while the liquids saturate the cellular tissue of the wood, and thus prevent the excessive absorption of the liquid parts of the varnish. In other words, the filling is to provide a foundation, as previously stated. The better this is done the more satisfactory will the finish be. Some woods are so very open of pore or grain that one coat of paste filler hardly suffices, and hence two coats must be given, or one coat of the filler and one coat of a surfacer, concerning which more will be said further on.

When filling wood let us first take into consideration the character of the wood as to its natural color. We can either finish so as to show the natural color, very slightly altered by the filler, etc., or finish by staining the wood more or less, as may be required. The paste wood filler is without coloring, excepting a slight putty hue, unless pigment is added to it; it will not alter the natural color of a light colored or white wood unless we add coloring to it, and this is sometimes done. But such is not the usual method for producing a color finish; we must stain the wood before filling it, then fill with paste filler, stained or natural, according to the finish desired, and which will be discussed more specifically in another place. Sometimes the wood is stained, and unstained filler is used, this in order to obtain certain special effects.

Some wood finishers practice filling or saturating the wood with raw linseed oil before paste or liquid filler is applied, adding a little japan driers to it. The purpose is apparent; it is to prevent excessive absorption of liquids from the filler and other subsequent coats. The practice is to be commended, excepting where the wood is of such character that oil will cause it to darken where a light or natural effect is wanted on white or pale wood. It will do on most woods, however, though very few finishers employ the method,

probably on account of the extra time required in the work.

There is a brush made especially for applying paste wood filler, but many finishers prefer a half-worn flat paint brush, one that is rather stubby; that is best for large surfaces, but for smaller parts it is found desirable to use a round paint brush, half-worn or short of bristle. Apply a good full coat of paste filler, and rub it well into the wood, for unless the wood becomes filled with the semi-liquid paste the finish will prove a failure. It is here that many finishers fail, not because they do not know better, but because careless or anxious to turn out quick work, which the employer usually demands. Sometimes a boy is set at this work, and of course the result is bad work, varnish full of pinholes, for instance.

After cotting the work liberally with paste filler and rubbing it in, let the job stand for about twenty minutes, more or less, according to temperature, the stuff drying very quickly in a very warm atmosphere, and slowly in a damp or cool one. It is safer to examine the stuff now and then, and just as soon as it has set, being neither dry nor wet, begin to rub off, using a pad of tow, or a bit of coarse burlap, and rub across the grain. As you rub press down on the pad, to keep the wood full of the paste, at the same time removing excess of filler from the surface. When this work is not done carefully the pad will take out some of the filler from the pores or grain, and so defeat the purpose of the filling. It may thus be seen that simple as wood filling seems, yet it requires a skilled hand to do it right.

When you begin to rub the filler see that the filler is neither too dry nor too liquid. In the former case it will be difficult to rub out, and in the other some of the filler will be taken from the pores. After rub-

bing, let the work stand for a day or, better still, two days, then sandpaper the work, to remove surplus filler and make the surface smooth.

The filler should be quite dry before the work is coated with surfacer or varnish, because if not dry it might cause trouble with the finish. The foundation is a very important part of the work of finishing wood, and when carelessly done the finish cannot endure, no matter how well it may be done.

I have found it useful to examine the filling with a low-power glass, which will show defective filling if it is there. The surface that appears perfect to the unaided eye may give quite another story when viewed by the magnifying glass. Should such an examination show that the wood has not been perfectly filled, and especially if the job is to be an extra fine one, you had better apply another filling, either of thinned paste or with a surfacer. The subsequent coats of varnish will not fill the wood where the filler has not done so perfectly. Usually the one coat of filler does, especially on common or ordinary work.

Carved parts, and other places difficult to get at with the filler brush, should be filled with paste filler made thinner than that used on the main body of the work. Apply it with a sash tool, say size No. 4. Then wipe off lightly with a bit of cotton rag. Should the filler set too quickly add a few drops of raw linseed oil to it. When the parts are dry rub smooth with No. 0 or 00 sandpaper; then dust off and finish. Surplus filler found in the corners, moldings, etc., may be removed with a piece of soft pine wood, whittled to a point. Another useful tool for such work is the bone handle of a toothbrush, one end filed to a point, the other end ground to a chisel shape.

Wood fillers are a commercial article, though some finishers prefer to make them in the shop. Personally I

prefer the ready-made fillers, because they are in better condition for use than those prepared by hand; they are made from the proper materials, and are ground and made even of texture in a degree not possible by hand, unless passed through a hand-mill. Something will of course be saved in cost by shop mixing, but even this merit has limitations, for the workman may spend too much time at the work, and so overbalance any possible saving. Yet in certain contingencies, as where a special kind of filler may be required, or where only a small quantity of filler may be needed, for a certain work, it will be better to make it by hand, As opposed to my preference, I have the opinion of another finisher, one of many years' experience, and who says: "If one could be sure of getting fresh-made filler there might be an advantage in buying the ready-made, where one uses large quantities of it; we use between 300 and 400 pounds of filler a week. All that is required is a tub capable of holding the quantity required, say up to 300 pounds, and vessels for weighing and measuring the ingredients. Put in the oils, add coloring if desired, and mix, then stir in the silex, a little at a time, working it in with the hands."

Leaving the question with the reader, let us now consider the subject of filler formulæ. These may be placed in two classes, commercial and shop-made. Of the former little needs be said. Factory formulas vary, according to quality and the use it may be intended for. The best grades have a silex base, but some good ones do not contain silex, but some other suitable base, such as barytes, China clay, etc. The following list of fillers embraces about all the paste fillers used.

Best Silex Paste Filler.—Mix together two parts of the best coach japan, and three parts of pure raw linseed oil, both by weight; in a suitable tub or other

vessel place the liquid, add color if desired, by stirring in, then mix in fine powdered silex to form a stiff paste. If you can run the mass through a hand-mill it will give a better mixed paste and save time. If this cannot be done, then work the mass with a paddle, or, as some do, with the hands, until perfect admixture is secured. When wanted for use the paste may be thinned down with turpentine to any required consistency.

A Light Paste Filler.—Take twenty-five pounds of best floated silex and eight pounds of China clay, mixed to form a paste with four and one-half gallons of raw linseed oil and three pints of best liquid driers, of light color.

Commercial Dark Paste Filler.—One hundred pounds of floated silica, three pounds of powdered soapstone (steatite), three pounds of Vandyke brown, one and one-half pounds of burnt sienna, two and one-half pounds of burnt umber, two and one-half gallons of raw linseed oil, and three gallons of strong thin driers.

Silica-China Clay Filler.—Mix to a paste twenty-five pounds of floated silica, four pounds of China clay, three quarts of raw linseed oil, and three quarts of the best grade of japan driers.

A smaller quantity of the above filler, and with some improvement in the formula, may be made by taking four and one-half pounds of the silica and one-half pint each of raw linseed oil, pale drying japan, or japan gold size, and turpentine.

Compound Paste Filler.—Mix together one pound of cornstarch, half-pound of powdered pumice-stone, of the finest texture, one gill of shellac, one gill of japan, and one-half pint of boiled linseed oil. Color if required.

Barytes Paste Filler.—Barytes fifty pounds, raw linseed oil one quart, very strong japan driers one quart, turpentine one quart, water one quart, brown

soap six ounces, and pulverized borax one ounce. Add the soap and borax to the water and mix well together. Then add this to the other liquids and stir all together.

Cornstarch Paste Filler.—Mix together one pound of corn starch and one-half pound of fine flour pumicestone, then add one-half pint of boiled linseed oil and one-fourth pint of shellac varnish. Add any coloring desired. Mix to a paste, and thin for use as required. An expert sent us the formula as being the best of its class.

Boiled Cornstarch Filler.—Mix together one quart each of raw and boiled oil, gold size and turpentine. Boil some cornstarch and while it is boiling add a little magnesia, two ounces to the pound of starch. Let the mass boil for about fifteen minutes. Any coloring may be used, and silica may be used in place of starch, if desired. When cold thin up with the liquid mixture.

Regarding cornstarch as a filler, it was the first base used for the purpose of filling woods. Prior to its use varnish was applied and left to become dry, but not hard, then it was forced into the wood by means of a chisel-shaped soft wood paddle. The demerits of cornstarch as a filler are its susceptibility to dampness, causing it to swell in the wood; and its liability to decay, under certain conditions, as it is a vegetable matter. It will appear strange to some that the starch, so protected by its surroundings of a varnish nature, should be affected by moisture or dampness. But it must be remembered that linseed oil is not impervious to dampness, as may easily be proved by placing water on some freshly applied but dry paint. The swelling of the coat of paint will indicate its absorption of water. So that we may conclude that starch does not form a good filler. It also does not fill the grain as well as silica, nor does it rub out as well. Yet some finishers prefer

and use it. Some of these advocates of starch use a liquid formed from equal parts of boiled oil and japan, others equal parts of boiled oil, japan and turpentine. In both cases the starch is made to a paste and thinned with turpentine for use. A good way is to pour the liquid over the starch and let it stand until the mass is well soaked with the liquid; cover it to prevent evaporation of the volatile liquid. Then the mass is easily mixed. If it should dry too rapidly add a few drops of raw oil. If too thick, add a little turpentine or benzine; the latter is the better, perhaps, in that it permits of the application and rubbing in, and that done the volatile thinner escapes and leaves the filling less elastic or thin.

Car Painters' Filler.—This formula is given by an expert car painter. Dry white lead one hundred pounds, best gilders' whiting one hundred pounds, keystone filler one hundred pounds, floated silica fifty pounds, dry lampblack five pounds, raw oil one-half pint, turpentine two gallons, brown japan seven gallons, and copal varnish two gallons.

Plaster of Paris Filler.—This formula is given simply to show how some paste fillers may be made, and are made and sold. Take plaster of Paris and form into a paste with equal parts of turpentine and japan driers; a little raw oil will make the filler work easier. It may be well to first add rather sparingly of the driers, trying the paste for its setting quality, and if too slow add more driers. A little litharge, some think, improves the filler. Stain, dry, may be used with it. Sometimes marble dust is used in place of the plaster of Paris. And of course silica may be used in place of either.

Wax Filler for Hardwood.—Take equal parts of raw oil, gold size japan and turpentine and mix with beeswax at the rate of four ounces of wax to the quart

of turpentine, first melting the wax in the turpentine. Now stir into the wax and turpentine enough floated silica to form a rather stiff paste, which then should be run through a hand mill or fine sieve. Thin with turpentine for use.

Glue Paste Filler.—Place seven pounds (almost one gallon) of water in a suitable vessel and add to it one pound of the best glue. Let it stand, say over night, in which time it should have taken up all the water it is capable of; then set the vessel and its contents in another vessel of sufficient size and containing boiling water, or at least hot water, set the vessels on the fire and boil until all the glue is dissolved. This will require but a few minutes. Then stir in, while hot, one or two pounds of dry powdered litharge and two pounds of plaster of Paris. Mix and let cool; it is then ready for use. It is intended for special purposes.

Non-Shrinkable Paste Filler.—Mix a batter of flour paste, as for paper hanging, and boil it. When sufficiently boiled set it away to cool. It should be cold but not too stiff when placed on a mixing board; it should be fluid enough to run from the board when mixing it. Now mix in another vessel raw linseed oil and whiting to the same consistency as the flour paste, then mix the two masses together; add enough japan driers to make the mixture dry right. For use thin with benzine. You may not be successful with it at first, as the filler must dry just right, harden, and act in the same manner as ordinary paste fillers.

Lime and Flour Paste Filler.—Mix one pound of powdered lime with two pounds of rye flour and form into a paste with common varnish. If it is desired to have it colored, use any dry pigment. Whiting may be used in place of lime.

Adding Color to Paste Filler.—It should be

stated here that in proportion as we add coloring matter we weaken it as a filler. Some colored paste fillers contain as much as one-fourth their mass of pigment coloring. But by using dyes the objection to coloring is of course removed.

When you wish to color a filler to match a certain kind of wood add the color very gradually, trying it at intervals as you proceed, by comparison with the wood. Make the filler rather darker than the wood, for the wood, if new, will darken slightly with the lapse of time; then wood and coloring will be about the same. For very dark wood it is better to make the filler than buy it. The proper way to color filler is thus: Take the lightest color first, if more than one is to be employed; mix with some linseed oil; then take the darker color and mix it with a little turpentine; add it to the oil mixture, and mix both together; then add and mix in the rest of the thinners.

Paste filler should always be made stiff, in order to save on the volatile thinners, which may be added when ready to use.

Table of Colors Used in Paste Fillers

LIGHT OAK.—Use raw sienna or yellow ocher.

DARK OAK.—Use burnt umber or drop black, or the two together.

GOLDEN OAK.—Use burnt umber or asphaltum, or both together.

WALNUT.—Use burnt umber enriched with a little Venetian red or rose pink.

BLACK WALNUT.—Color the paste filler with Vandyke brown.

MAHOGANY.—Use burnt Italian sienna, rose pink, and a little drop black.

REDWOOD.—Use burnt sienna and a little rose pink.

Brazil Wood.—Use rose pink.

Cherry.—Use either burnt sienna or Venetian red.

Fillers for the Various Woods

Ash.—A wood having very open pores and coarse of fiber. Mix together two parts of pale linseed oil (bleached by preference), three parts of japan gold size, and one part of turpentine; add fine floated silica to form a paste.

Butternut.—Same as for ash.

Beech.—Same as for birch and red gum.

Birch.—Use a surfacer, made from thin white shellac varnish (a pound of bleached shellac to the gallon of alcohol).

Cherry.—Best whiting one pound, plaster of Paris two pounds, dry burnt sienna one and one-half ounces, dry Venetian red one ounce, boiled oil one quart, turpentine and brown japan one pint each. Silica may be used in place of whiting, but the latter enters the pores better, and the plaster of Paris gives sufficient coarse material.

Cypress.—Being a close-grained wood it may be surfaced with either liquid filler, made by thinning paste filler, or with a heavy coat of shellac. Shellac is the best of the two surfacers, and two thin coats are better than one heavy coat.

Chestnut.—A coarse, open-grained wood, and hence requires a stiff paste filler. The filler may be used without coloring, unless for special cases, as where stain may be needed to make different parts match when they do not do so naturally.

Elm.—Coarse grained and requiring same filling as chestnut.

Ebony.—Mix plaster of Paris with lampblack and thin to a paste with brown japan or gold size.

MAPLE.—Use a surfacer, or white shellac varnish.

MAHOGANY.—Take equal parts by weight of best whiting, plaster of Paris, flour pumicestone, and dry powdered litharge, to which may be added small amounts of pulverized soapstone, Vandyke brown, burnt sienna and yellow ocher, these in the dry condition. Mix to a paste with one pint of japan, two pints of boiled linseed oil, and three pints of turpentine; grind in a hand-mill.

OAK.—To give the natural color finish, use the usual uncolored silica filler. To give a higher color than the natural finish add some burnt sienna to the filler. For dark oak the filler given for ebony will do; burnt umber may be substituted for the black given in that formula. For golden oak, color the ordinary paste filler with burnt umber and asphaltum, four ounces of the former and one-half pint of the latter to ten pounds of paste filler.

ROSEWOOD.—Use the same filler as given for mahogany.

RED GUM.—Same as for birch.

REDWOOD.—Cornstarch one pound, dry burnt sienna one-fourth pound, mixed with one quart of turpentine, and a tablespoonful each of raw linseed oil and brown japan.

WALNUT.—Mix together equal parts of China clay and rye flour, coloring with burnt umber; mix to a paste with two parts each of turpentine and japan gold size, and one part of boiled oil.

WHITE PINE.—Surface with white japan or uncolored paste filler, thinned with turpentine to a liquid condition.

Some Paste Filler Notes

The filling may be coated over in twelve hours after

it has been applied, but twice that time would produce better results in the finishing.

Two thin coats of filler are better than one very stiff coat, and the coats should have twelve hours between.

An old shop rule was to use from twelve to fourteen pounds of stiff paste to the gallon of thinners.

A filler should be made to suit the kind of wood you have in hand; it should be neither too heavy nor too light in weight. Heavy filler causes rough surface, difficult to make smooth.

After filling the wood wait until the filler has a dead, whitish appearance before rubbing off. Rub across the grain of the wood, not with the grain.

Paste filler should fill these conditions: It should fill the wood perfectly; it should be solid and not easily affected by moisture or atmospheric conditions of any sort; it should readily unite with the fibers of the wood, so that nothing can disturb or alter it as long as the wood remains intact; it should be translucent, showing up color and grain of the wood; it should be a simple compound, not costly, and easy of application and rubbing out, and of such nature that it will never cause swelling or shrinkage.

Too much oil is not desirable in a paste filler. The oil will shrink, causing the filler to fall away, and thus marring the finished surface. Although we have given formulas that contain other bases than pulverized silica, we still give the preference to the latter substance as a base. A pure sample of pulverized silica will show perfect translucency, and it may be ground to an impalpably fine powder without injuring its virtue as a filler; and this is important, as we demand a fine base substance. No matter how fine you grind or pulverize the silica rock it will still retain its crystalline formation, and it is the little crystals that hold the

filler in the pores of the wood. Silica has also an affinity for the liquids necessary for its preparation as a filler.

Liquid Wood Fillers.—Liquid filler is simply a varnish slightly bodied with silica or similar substance. This filler is also a surfacer. The terms are interchangeable. The purpose of such liquids is to form a foundation for the finishing coats of varnish. The reason they are used instead of paste filler is this: Paste filler is too coarse and heavy to enter into the close-fibered woods that liquid surfacer is used on. Shellac varnish is sometimes used as a surfacer, but it costs more than varnish, and in most cases possesses no advantage over ordinary varnish surfacer; in fact, some finishers prefer the latter.

If you make your own surfacer or liquid filler use the best materials; it is advised that you use the same grade of varnish that you will use over the surfacer. Such a surfacer will work easier than one made with cheap varnish, and it will give a smoother job and bear up the finish better. As one expert says, two coats of varnish on such a surfacer will equal three coats over shellac.

Here is a good formula: Mix together one gallon of good copal varnish, one-half gallon of light brown japan, and one pint of turpentine. Sift into this six pounds of floated silica, and stir until perfectly mixed; let it stand twenty-four hours, thin out with turpentine, and strain through cheese-cloth. This surfacer should be allowed at least twenty-four hours for drying before sandpapering and applying the varnish coats; all should be done in a temperature of about 72 deg. F.

Liquid filler or surfacer should be applied like varnish, in full, flowing coats, leveling it out to form as smooth a surface as possible. When a cheap surfacer

is used there is apt to be a more or less rough or ridgey surface, hard to make smooth with sandpaper. One merit at least of shellac is that it can be used very thin, and hence it flows out smooth, so that it will not need the same amount of smoothing as average copal varnish surfacer.

Sometimes liquid filler is used on such wood as oak, to save time that would be necessary with paste filler, but such work is very cheap-looking. Much house trim is done that way, with no sandpapering and but one coat of copal varnish over the filling. In this case the filler is made heavier than ordinary surfacers.

When liquid filler is to be colored we meet with a new difficulty if we use silica, because the pigment is much lighter in gravity than the silica, as a rule, and hence when mixed with thin varnish it will settle more or less; of course it may be kept stirred, but that is a bother and is apt to be forgotten; the result being that the coloring is unequal and the work spotty. To avoid this difficulty cornstarch may be used in place of silica. There may also be used China clay, talc, whiting, etc., but these have the fault of fading out or whitening in the wood, even though the coloring is added. Carbonate of magnesia, sometimes used in fillers, holds up pretty well, and is much better than whiting. As to the filler whitening in the wood, even silica will do this to a certain, though not to a serious extent.

Silica paste filler may be thinned down to the desired consistency and be used as a liquid filler or surfacer. To prepare paste filler for this purpose first add varnish, to form a rather stiff liquid, then add turpentine or benzine to form the surfacer.

Mention has been made of starch filler, but it was not explained why starch was preferred by some finishers. The reason is that such a filler, paste or liquid, works easier than the silica filler, and also on account

of being soft the workman can rush the work faster than when using silica filler. But it does not hold up varnish as well, though it seems to fill the wood all right, but as it dries it hardens and shrinks, leaving wood but poorly filled. Moreover, it requires more time for hardening, so that as a rule the varnish coats are applied too soon. In a short time the finish will look poorly filled, and the varnish only shows this up more plainly. And where this is not very evident to the naked eye it is all too evident when viewed under the microscope.

Too much praise cannot be given to silica as a filling substance, yet it would be wrong not to mention any possible fault; it has at least two, namely, it settles badly in the pot when in use, and it dries out too rapidly for easy work. Yet even these faults are not serious, because we may overcome the rapid drying with a few drops of raw oil, and too quick setting is an evidence of its durability, besides which most finishers like to have it set soon so that the job may be pushed. Some finishers add a great deal of oil to the filler, or surfacer, and in this case the drying would be rather slow, though easier to handle.

Where surfacer or liquid filler is bought by the barrel the vessel should be kept covered, to keep out dust and dirt and to prevent evaporation of its volatile ingredients.

Some Liquid Filler Formulas

Silica Liquid Filler.—Use the finest silica, that which is known as floated being the best, and add from four to six pounds to the gallon of good varnish, many using coach varnish, the hard drying grade. To this add two quarts of brown japan and one pint of turpentine. Another liquid, a mixture of equal

parts of raw oil, gold size japan and turpentine, may be used in place of varnish. These proportions will give a stiff paste, which may then be thinned for use with turpentine. Another mixing liquid is composed of one gallon of good varnish, with driers sufficient to dry the surfacer in the desired time; much difference exists in the strength of the various japan driers, hence it is best to try the drier if you are not accustomed to the use of a particular brand that you have, and after ascertaining its strength it will be easy to fix upon a formula containing it.

Transparent Filler.—This is useful on white or very light colored woods, where the natural color and grain is to be preserved. Mix two pounds each of cornstarch and fine powdered pumicestone, thinning with one pint of shellac varnish, the white or bleached, and boiled linseed oil. Mix to form a paste, and thin for use with turpentine. Silica may be used in place of pumicestone. For certain jobs white damar varnish may be used in lieu of white shellac, but damar varnish is very soft. It has been used on church work where the ordinary colorless filler stained the wood more than was desired, and it preserved its whiteness and did not need any sandpapering; two coats of copal varnish over the damar gave a good finish.

China Clay Filler.—Mix together one gallon of pale, hard-drying carriage body varnish and one pint each of turpentine and pale japan. To two and one-half pounds of the clay add enough liquid to form a paste, which should be run through a hand-mill, though hand-mixing will do, if done thoroughly. The rest of the liquid may then be stirred in; stir it briskly until the mass is mixed perfectly. May be used as a paste filler if not thinned as for liquid filler.

Imitation Shellac Varnish.—Take equal parts of raw oil, turpentine, brown japan and rubbing var-

nish, and add cornstarch to form a paste. It is made stiffer than the usual surfacer or liquid filler, being a little thicker than ordinary oil paint, but it must not be too heavy or thick, or it will not be easy to manage. After its application let it set, then rub with a coarse cloth, same as for paste filler, and rub well into the wood; give two coats of this filler, if the nature of the wood requires it.

Another formula calls for four pounds of floated silica, or China clay, and one quart of japan, beating the mass with a paddle until mixed perfectly. Then add, while stirring, six quarts of the best hard-oil finish or other varnish of like grade, after which let the mass stand an hour or so, then run through a fine sieve or muslin. Thin for use.

Oil-Thinned Filler.—Mention has been made of the use of oil in paste fillers. Many of the best yachts are said to have all exposed woodwork done with oil-thinned filler or surfacer, with coats of spar varnish for the finish. This spar is an elastic varnish. Each coat, of which there may be several, is allowed ample time for drying, and each coat is well sandpapered. The process demands much time and work, but this is necessary owing to the wear such work has to sustain. Some steamships have all exposed woodwork done this way.

Concluding Remarks.—As previously stated, the terms surfacing and liquid filling are synonymous. Then there is the term priming, another finishing room technical term for the first coat, and which is identical with the other terms mentioned. In short, the act of coating the wood the first time embraces filling and making a foundation for the varnish coats that are to follow. But sometimes a filler or surfacer follows a paste filler, to complete the filling when the first coat does not do it perfectly.

These liquid coatings should never contain any rosin, for rosin will cause trouble with the finish.

Some finishers do not use shellac under copal varnish, saying that the latter will not adhere perfectly to the shellac. But if the shellac has been well sandpapered there is no danger of non-adhesion. Nor does it often occur that adhesion is defective where no sandpapering is done.

There may be liquid fillers or surfacers on the market that contain some water; water will raise the grain of the wood, hence it should never be used in such coatings.

Filling and Finishing the Various Woods

Ash.—A coarse, open-grained wood, and light in color. Fill with stiff paste filler, uncolored. The finishing is same as for oak.

Butternut.—Sometimes called white walnut. Same filler and finishing as ash and oak.

Beech.—A close-grained wood, with delicate markings; there is also a curly variety, and the quarter-sawed wood is very handsome. Beech may be finished natural, or be stained walnut, cherry or mahogany. Natural finish should have a full gloss. Plain beech should be carefully stained, owing to the danger of obscuring its rather indistinct markings; a transparent stain is best, and if a pigment stain is used it should be wiped off with care, as soon as possible after being applied. Water stain should be used, but some prefer a spirit stain or chemical stain in oil.

Birch.—This is a close-grained wood and requires a liquid filler, light in color for natural finish, and darker for stained finish. If shellac is used take white shellac or orange, respectively. As to shellac, some use as much as five pounds to the gallon of alcohol,

while others say a thin coating is better, say, one pound of shellac to the gallon. Use your judgment.

When birch is intended to imitate certain other woods, the curly red wood is to be preferred. The imitation may be mahogany, golden oak, green oak, or rich chocolate brown. Natural finish of both red and white birch is very fine, and it should have its last coat made a dull finish. Some think that this wood is spoiled by staining. Some finishers use paste filler, saying that it lessens the effect of water-stain on the wood. When thus filled the work is left to stand twenty-four hours, when it is well sandpapered and given a priming coat, tinted to required shade of color wanted. Lake color is best for this purpose. In another twenty-four hours sandpaper again and flow on a full coat of the best pale cabinet polishing varnish. Finish by polishing, as described elsewhere.

Usually there are three finishes, namely, golden, golden red and dark red. For the golden finish use raw and burnt sienna, with a touch of lemon chrome yellow. Oil-colors are indicated here. Mix the pigments with the surfacer, following with a second coat of uncolored surfacer or thin varnish, and finishing with a coat of polishing varnish, which may be polished as desired. A finer effect may be obtained by using red and yellow lakes; these will show a color-tone the same as the oil pigments, but with the difference that the coloring will be transparent, leaving none of the little flakes of color seen after using the oil-color method. The light red may be made from burnt sienna, and the dark red from burnt sienna and Vandyke brown. These colors are also sometimes applied as a stain, being thinned out with turpentine. In some cases the pigments are combined with the primer or surfacer. This latter method is perhaps the best, but the use of transparent pigments is advised.

To stain dark birch mahogany color, first give it a weak solution of bichromate of potash; let this dry; then the following stain: Rose pink, Vandyke brown, and burnt sienna, in such proportions as will give you the desired color. Apply the stain, let it dry, sandpaper lightly with fine paper; then give it a coat of shellac, tinting the shellac with a little Bismarck brown, to give the wood a more uniform coloring.

Birch may be made to imitate cherry or walnut, as well as mahogany. The last coat of varnish may be rubbed with o or oo fine pumicestone powder, rubbing with oil and not with water. A birch door stained mahogany color gives a beautiful effect in connection with white enameled woodwork, and this is, in fact, the general practice. Many prefer this effect to the real mahogany wood, especially where the curly birch is used.

Oil stain is liable to obscure the grain of this wood, and rose lake will fade out in time. So that water stain is perhaps more useful, upon the whole, than oil stain; it takes the dye deeper into the wood, and it does not rub through as oil stain will. However, as there is always a difference of opinion among even expert workmen, it will not seem strange that some prefer the oil stain, using burnt sienna, burnt umber, and rose lake, in due proportions.

After staining the wood and allowing it to become dry, rub lightly with fine sandpaper, and give it two coats of thin shellac, rubbing each; follow with a coat of varnish, which rub with curled hair, which is often safer than sandpaper, especially where there are corners, etc., that may be cut by sandpaper. Finally a coat of varnish, which rub to a dull polish with finest flour pumicestone and oil. The directions given in the foregoing are particularly useful for doing birch doors. The shellac is useful in holding up the varnish, which

is important from the fact that exterior work is exposed to the weather and sun, hence must be made even more durable than interior work.

It should be stated in conclusion that birch, while possessed of many merits, has the reputation of being a "treacherous wood," as it is expressed by some finishers, on account of some chemical action which is said to take place between the wood and stain; the effect shows up in a year or less, appearing in the form of a dirty brown color.

CHERRY.—This is a fine wood for staining and finishing to imitate mahogany. It is seldom finished natural color, yet when so done the effect is very pleasing. Usually it is stained with burnt sienna, in oil, as water staining often results in laps showing, thus spoiling the finish. When this occurs you can rectify the damage by wetting the edges of the laps with clear cold water, also the adjoining parts, after which apply the stain.

First of all, see that the work is made smooth and perfectly free from dust, as the least speck showing on the finish will mar the whole, if a gloss finish is in view—and this is the best for cherry. Most finishers give the wood a surfacer, yet there are some that apply paste filler, with a thin coating of surfacer or shellac over that. In this manner cherry may be finished the same as maple. Burnt sienna makes a good stain, as for color, but Bismarck brown gives a handsome effect, though not so durable a coloring. Certain vegetable stains, such as alkanet root and dragon's blood, give very pleasing coloring. Apply stain freely, but avoid making air bubbles.

CYPRESS.—This is a wood liable to give trouble, owing to its liability to contain moisture, for it is difficult to dry perfectly. But once it is dry there is no more trouble to be apprehended than with other woods.

If cypress is not perfectly dry when water stain is applied the wood is more than likely to show a risen grain. Another trouble met with in the finishing of this wood is the oily substance that is met with in different parts of it, existing more or less in every part. In general the finishing of cypress is about the same as with birch or cherry. Apply a first coat of shellac, when dry sandpaper, then give it two or three more coats of shellac, sandpapering each coat. Even all this shellac is not sure to hold back the oily substance mentioned. It is well to first size the wood with benzol, which will cut the gum. Some recommend a size of vinegar stain, following with a coat of shellac, then with a coat of hard varnish. If water stain is to be used it will be wise to first prepare the wood with a coat of gelatin size or very thin shellac. Turpentine stain would be better than water stain, for it would not raise the grain as much. Never use a drop of oil on cypress, for it never would dry. Painters know this from experience in painting over the raw wood. Unless the wood has been shellacked or otherwise treated to seal the gum, oil paint, or even turpentine paint, will not dry in a week.

If it is desired to use cypress for imitation oak of Mission coloring, take the wood that is straight of grain. Make the stain from japan drop black, adding a drop of rose pink; mix to a paste with interior varnish, and thin out with turpentine to form the stain; strain through cheese-cloth. The shade or depth of color may be modified by either thinning it or by adding more black. A greenish effect may be obtained by omitting the rose pink and substituting dark chrome green for the black. Imitation antique oak may be made with stain made from two parts of Vandyke brown and one part of raw umber, with a little drop black; these are to be ground-in-japan colors. Mix to

a paste with varnish and thin out with turpentine. In either case the finish may be done in varnish, which may be rubbed down, or flatting varnish may be used, and some prefer wax finish.

CHESTNUT.—This is another coarse wood, belonging to the same class as oak and ash. It should have a rather stiffer filler than that used on oak, but the work otherwise is the same as on oak.

ELM.—This wood has a large pore, but it is not as deep as that of oak and ash; it is also easier to fill than those woods. Some elm wood contains sap spots, which show up lighter than the rest of the surface; such spots must be stained to look like the other parts. After the wood has been filled and sandpapered take a cup of water stain, composed of either burnt umber or Vandyke brown, and a soft rag and go over the sappy parts with it. This will give a uniform coloring to the whole surface.

One of the objectionable features of elm is the fuzz, sometimes alluded to by finishers as the wood's whiskers. This catches the filler and causes muddy, uneven coloring. The best method of doing this wood was given us by an expert of many years' experience. It is sure to give satisfaction where carried out carefully. Instead of using paste filler use the following materials and methods:

First prepare a liquid surfacer by breaking up some silica paste filler of medium antique oak shade, using turpentine for this purpose, but no benzine. The latter would cause too rapid evaporation, causing brush marks. Mix together as much of this filler as of liquid filler, then add half as much turpentine as you have of the two mixed surfacers or fillers. Stir the mass well. You may now make any desired change in the color by adding burnt umber or burnt sienna, or both. Apply this liquid with a flat chiseled soft-bristle brush, of a

width of two and one-half inches. Apply the filler carefully, spread it uniformly and even, and wipe out the corners, etc. Lay it off as when staining a job, and when all is done let the work set, as usual in filler work. Rub off in about fifteen or twenty minutes. Let it then stand twelve hours or so, when it may be sandpapered with No. 0 sandpaper, rubbing lightly and making the surface smooth; then it is ready for the primer or surfacer. Let this stand twelve hours, then rub down smooth with sandpaper, when it may be given a coat of rubbing varnish, or gloss varnish, according to the kind of finish desired.

Selected elm gives as beautiful a figure as any fine wood we know of. When properly finished the furniture made from it cannot be told from fine walnut by the public, hence it is often sold as walnut, being its equal in every respect. Veneers cut from selected elm show up the wood's beauty even better than in the solid. Such veneers should be cut by the rotary process to get the best effects. And experts have found that the best results in the finish can be brought about by filling with surfacer, as directed, using the surfacer very thin and sandpapering smooth, then applying an oil stain, which may be rubbed in and off with a rag or waste, giving a very pleasing uniform coloring. Or asphaltum stain as a base may be modified with some oil color, such as will give a brown tone to the finish. Do not make it too dark, as this will cause a too bold figure; if just dark enough the figure will be subdued, but yet apparent.

Ebony.—One of the real hard woods; there is no difficulty classifying it. Seldom used in the wood finishing department. It may be polished with oil and shellac, in the French polishing way, or be shellacked and varnished and rubbed. It looks best with a dull finish.

MAPLE.—A close-grain hard wood, with even texture that admits of easy finishing. Light of color, it ranges from gray to almost white. The two woods, curly and straight grain, usually differ in color tone, the former being inclined to a cold gray and the latter usually a warmer tone of gray or gold. In either case a primer of white shellac is the practice, and while in some cases one coat suffices, as many as four may be given, depending upon the character of the job. It is finished with pale copal varnish. The shellac alters the color of maple less than any other liquid we can apply, and the fewer coats given the nearer the color will remain to the natural. One coat of copal varnish, even the very palest, will add some color to the wood, after the priming coat, and the more varnish the more color, though this is not always an objection, as the color thus produced is always of a very pleasing golden glow. Maple flooring requires sufficient coats of varnish to protect it from the wear incident to such surfaces. Furniture may do with less, as the wear is very little. The varnish should be allowed plenty of time for drying, and if you expect to produce a fine piece of maple finish do not hurry the work. The dark varnishes are the quicker drying, so that you are barred from using them, using the slower and paler ones. Damar varnish is nearly white, but it is too soft for this kind of work. It is impossible to rub it.

Maple should be finished with a full gloss, as this wood appears lifeless when rubbed to a dull surface. The work should come to the finisher perfectly smooth, and he should see that every speck of dust is removed from it before beginning the surfacing. Maple is rarely stained, but some like the delicate green tint given to it by the application of copperas water. Allow four days for the drying of a coat of varnish, and

five days is better for the last coat, which may be rubbed with flour pumicestone and water, using a piece of felt for the rubber; on this rubbed surface apply the gloss coat of varnish. If a dead finish is desired, then follow the rubbing down with rottonstone powder and water, using a felt rubber.

MAHOGANY.—This wood requires paste filler, and care in the filling is required in order not to obscure the beauty of the figures. Fill the wood level full, so that there will be formed a perfect foundation for the subsequent coats of varnish. Having filled and smoothed the surface, apply a coat of shellac, which in turn is made smooth with fine sandpaper. Then give it another coat of shellac, rub down, and finish with two or three coats of copal varnish.

Mahogany is a rather spongy wood, and has much raised grain, a sort of fuzz, which causes some cloudiness in the filling. In some instances this fuzz runs in opposite directions, adding to the difficulty in both the working and in the finishing. These soft fuzzy places should be shellacked after the application of the water stain, and not before; the shellac should be quite thin. Then it is ready for the filler. The shellac forms a glaze over the rough places and so prevents the filler from lodging there.

An expert gives the following as his method of finishing mahogany: First sandpaper the wood until it is perfectly smooth, dust off, then apply a stain made from water-soluble Bismarck brown. Let this dry, then apply a coat of thin shellac—two pounds to the gallon. This lays the fiber of the wood, but does not interfere with the filling of the wood. When dry and hard sandpaper lightly and dust off. Then apply mahogany paste filler; thence proceed as directed for paste filling. Then apply a coat of shellac and the

varnish coats; the shellac may be dispensed with if so desired.

Usually it is best not to stain mahogany very dark, for its natural color is rather light, much like that of Spanish cedar or cigar box wood; yet a little stain certainly does improve the wood by making the coloring more uniform than it is in the natural. If the wood is of an inferior quality it is better to use a dark stain. A black filler, by making a black pore, shows up the finer markings of the wood.

Fine mahogany is a study in itself. Its markings are so delicate and its shades so rich and varied that special care is required in the development of all its beauty.

If an old mahogany appearance is desired it may be obtained with solution of bichromate of potash. If a richer color is wanted, then use aniline stain that is both water and spirit soluble. This may be applied to the natural wood, or after the filler. Sandpaper smooth and apply a coat of shellac. This will bleed the stain again, which in turn will cover the marks of the sandpaper and prevent the oil of the varnish from entering the wood; oil will injure the wood by darkening it. Piano finishers get the best results in finishing mahogany, and they never allow oil to get to the bare wood. But some finishers, who are not afraid of the oil, add about forty per cent of turpentine to it, with a little good japan drier, this carrying the oil down into the pores of the wood, so that it affects the color of the surface very little, they claim. But it is best to omit oil on this wood, and even shellac can be dispensed with, for it is often a source of trouble in the finish. For instance, greening of the finish has been traced to the shellac, which likely has carried some water with it, thus affecting the varnish coat.

For further particulars regarding mahogany finishing see the subject of piano finishing, in another part of this work.

Oak.—An open-grained wood, requiring paste filler. The work should be sandpapered smooth before the finishing is begun. The wood is finished in more ways than any other wood used by woodworkers. The principal finishes are natural, light antique, dark antique, golden, in various shades, fumed, Flemish, weathered, Antwerp, green weathered, cathedral, brown, and Mission. In addition there have been numerous colored finishes, ranging from blood red to almost black. But there is this characteristic in oak, that no matter what the finish may be, there is no disguising the wood; it always stands out as oak. This cannot be said of any other wood, we believe.

A good paste filler for natural finish can be made from the formula given for oak under the head of "Fillers for the Various Woods." See item Oak.

A finisher tells us that his practice is to always stain oak for the golden effect before applying anything else. This should stand from three to twelve hours, the latter preferably. The stain should be very thin, and it will then run into the pores of the wood, where it will be absorbed, none of it lying dead at the bottom. Don't wipe the stain off, but let it dry there. Then the filler should be applied. As the only purpose of the filler is to fill the pores of the wood, it need not be heavy; ten pounds of paste to the gallon of turpentine or benzine will do. Color it with the best drop black, in oil. Spread it over the stained work, and let it remain until right for wiping off; this will remove surplus stain and bring out the flakes of the wood, if quarter-sawed, as clear as though shellacked. On rough straight-grained wood it will not show cloudy,

smeary effects, as may too often be seen on this class of work.

Fumed Oak.—The successful fuming of a wood will depend upon its content of tannin or tannic acid; without this no wood can be successfully treated to give the fumed appearance, excepting as an imitation, and which will be discussed further on. White oak gives the best results, both on account of its very light color, and owing to the fact that its tannin content is very high. Chestnut is equally rich in this chemical, but as a wood it is not as desirable as oak.

Fuming has certain important features; it does not raise the grain of the wood, nor does it show the mottled effect that staining does under wax finish; and wax finish is the best kind for this class of work; it makes a uniform, even coloring.[1]

Fuming can be done either in a box or ordinary room, according to the size or number of the articles that are to be treated. In either case the enclosure must be air-tight. There must also be provision for observing the process, a pane of glass inserted in the box, and window in the side of a room. A good plan is to have a strip of the wood that is to be fumed inserted in a slot, so that one end of it may be in the room, with the other end outside, and so arranged that it may be withdrawn from time to time, to note depth of color. No definite period of time can be given for the process, as it all depends upon the size of the box or room and strength of the ammonia used, together with the depth of color desired. An approxi-

[1] The original "fumed" oak was finished with one or two coats of shellac, thoroughly waxed. This is still considered correct and is most widely used. But some, particularly architects, specify fumed oak to be finished one coat of shellac and three coats of varnish, rubbed with pumicestone and oil to an egg-shell gloss.

mate period is somewhere between twenty-four and thirty-six hours. If you have the strip of wood arranged for observation, as above described, you will not need the window. As the natural white or light-colored wood will continue to appear light even after it has been fumed, taking the dark fumed effect only after having been finished, it is well to wet the strip now and then with water, which will give a color about that of the wood when finished. Certainly the wet color shown thus will be as light as the finish can possibly be.

Before placing an object in an enclosure for fuming make sure that all glue spots or specks of dust and dirt are removed, for all such objects, large or minute, will show unfumed spots. Also see that every part of an object is exposed to the action of the ammonia, that no part overlaps another part. Successful fuming comes only from the observance of cleanliness and smoothness of the wood, combined with proper ammonia and air-tight enclosure. Much depends upon the woodworker, who should be careful to get the wood properly assorted, so that each batch fumed will be as near alike as possible in grade and color.

Fuming is done with strong ammonia, the 26 deg. kind being required. The stronger the ammonia the quicker and better will it do the work. For a room of two thousand cubic feet space one gallon of strong ammonia, placed around in shallow dishes, will do the work. Observe this proportion for smaller spaces. Ordinary fuming may be done in about twelve hours, but such dark finishes as Flemish will require a much longer time. And there is a patented process which does the fuming in six hours, anhydrous or ammonia gas being applied direct into the fuming place. Where much fuming is done it is economical to use the am-

monia gas, instead of liquid ammonia. This gas is used by ice-makers and by refrigerating plants in general. It is a liquid gas, compressed in the cylinders. There is also a kiln made for the special use of furniture making plants, designed for using this gas.

After completion of the fuming process open up the room or box and remove the fumed articles. The ammonia fumes will soon escape after you have opened the door and window.

The following is a description of the fuming process given by an expert workman. It contains a few points not embodied in the foregoing account.

"The first and most essential matter is to have the wood well selected, dressed and cleaned. The fuming box is made of wood, 10x30x10 dimensions. It has an outer and inner wall, with paper between. Also a window with double sash, which works on hinges; the inner sash is made to open inward, and the outer sash outward, and when both are shut the box is air-tight. A door is then placed at the end, something like the door of a refrigerator. On the inside a rack is constructed, to hold the wood that is to be fumed; wood in any form should be so placed that the fumes can get to every part. An iron drum capable of holding ten gallons of the highest grade ammonia is attached to the outside of the fuming box, at about the middle, and a pipe of two inches diameter runs from the top of the drum into the fuming box. The fumes passing through this pipe into the box are regulated by a valve. For a light shading the object being fumed is allowed an exposure of eighteen hours, and for a darker fuming two to four hours' additional exposure is allowed. In the latter case, when the object is removed and found too light, it is treated with a coat of liquid consisting of seventy-five per cent boiled linseed oil and twenty-five per cent turpentine; this coat-

ing is at once rubbed with a cloth until apparently dry. This darkens the color to the desired shade, and also serves as a finish. Wax may also be added, and rubbed to a finish.

Imitation Fuming.—This is effected by applications of liquid ammonia, full strength, or diluted, as to depth of color desired. The ammonia will raise the grain of the wood. The ammonia should be used only in the open, or where there is sufficient ventilation to carry off the fumes. Coat the surface quickly and evenly, being careful that one part does not dry before its adjoining part is done, which would form laps. It is best, as a rule, not to use too strong an ammonia, but to dilute it, more or less, for this will make the operation easier and less liable to make bad work. A chair, for instance, to coat which it is difficult to keep the ammonia from running on to another part; we find this difficulty, too, with water stains.

Imitation fuming may also be done with water stains, a few formulas following:

Boil an ounce of catechu (Gambier) in one quart of water, strain it, and apply hot to the wood. When dry brush the surface over with a solution of one ounce of bichromate of potash solution, made with one and one-half ounces of water. Should the color not prove deep enough add another coating.

A solution of iron filings or nails immersed in strong vinegar or acetic acid until enough of the iron has been corroded off to form an inky liquid will give a good imitation, but the solution must be thinned out, and several coats of it be applied, or as many as may be required to give the required depth of tone. This stain gives a silvery appearance to the wood, if the wood contains tannin.

Ivory drop black, ground in japan and thinned down with turpentine, is sometimes used to get a fumed ef-

fect. It does not raise the grain of the wood, and it should be wiped off with a cloth.

Or take burnt umber, ground in oil, and darken it a little with lampblack, in oil, then reduce the mass to a brown with zinc white, in oil. Thin it out with a mixture of equal parts of brown japan and turpentine, making a thin stain, which is to be applied freely to the wood. When it has set wipe off the surplus and fill with uncolored paste filler. Remove surplus filler and finish with wax. This stain does not raise the grain of the wood.

A green fumed effect may be obtained by using the formula given for the second method, with cutch, etc. (the catechu-potash solution formula). Add to the potash solution a little soluble Prussian blue, just enough to give it a tinge of green.

An effect known as the antique, but similar to the fumed method, is made by spreading fresh burnt lime paste on the wood; this is very caustic and burns the wood, thus coloring it to look like ammonia-fumed work. When the lime paste has dried remove it. All darkening of oak may be said to be imitation of fuming, and there are many ways for achieving this result. Potash solutions of varying strength may be used, and which will impart colors ranging from light brown to near black. In full strength it gives a very dark red, a deeper tone than that made with ammonia.

To give cherry or birch a reddish tone apply ammonia solution first, and follow with a potash solution.

To imitate oak on ash, elm, alder, box, chestnut, maple, yew, or sycamore, apply acetate of iron, or copper nitrate. The two solutions may also be used by mixing together, producing another effect. All such solutions must be used when cold.

Rosewood.—This wood has a coarse grain and needs paste filler. The filler should be stained to match

brown powder or walnut crystals, dissolved in water.

In general the treatment of gum is the same as for birch, which see. But there remain a few more words on the subject. There is interior trim, which demands a different procedure than furniture. In the first place, it should be managed by the wood-worker properly. If the trim is to go against damp plaster the back of the wood should be soaked with linseed oil, to prevent moisture from entering. Then blunt, not pointed, nails should be used for driving fast the trim; the former will simply crush the fiber before it, and the latter will act as a wedge and split the wood. And where allowable, screws are better than pointed nails.

The natural finish for red gum calls for a thin coat of white shellac, finishing with two coats of a good quality copal varnish. Or, if it is to be stained, apply the stain before the shellac and wipe off lightly before the stain sets. Then the coat of white shellac and two coats of varnish. As previously stated, gum needs no filler, and painters, not knowing this, will often do the filling, and this destroys the fine figure of the wood. Red gum lends itself admirably to wax finish, dull, or to oil finish, rubbed. We speak particularly of the figured red gum. But all the wood is handsome. Any of these stains may be used with satisfaction: Light and dark mahogany, black American walnut, French and Italian walnut, Circassian walnut, Flemish brown, Forest green, Mission, Dutch brown, and Silver gray.

There is also quartered red gum, with a peculiar grain that, when stained mahogany, shows the changeable color tones in imitation of mahogany. Either walnut or mahogany stain will give very pleasing color effects. Do not apply the stain too heavy, so as to cloud the figures, but just enough to show the fine grain of the wood. If wax finish is desired, give it one coat of white wax and when dry sandpaper and

apply the prepared wax. For walnut finish use this formula:

1¼ oz. walnut crystals
¼ oz. blue-black nigrosine
Mix with two gallons of water.

If a lighter stain is preferred reduce this stain one-half with water. Finish with two coats of white shellac, which sandpaper and wax.

For an eggshell gloss apply two coats of white shellac, two coats of clear rubbing varnish, and two of polishing varnish. Let each coat dry, rubbing down with fine steel wool between coats; rub the last coat with fine pumicestone and oil.

Inasmuch as public buildings are subject to hard usage of the woodwork it is well to not use heavy-bodied varnishes on the finish. Shellac and wax finish are probably better, at least from this standpoint; they will not crack or show scratches readily, and the finish is more readily kept in repair. A finish dull-rubbed with oil and pumicestone powder is the best for the public and private building.

Sycamore.—The plain sycamore wood is very attractive, but the quarter-sawed is even more so. Neither should be stained, but should be finished natural. Use very thin shellac, and either white or orange shellac, according to whether you wish it natural finish or slightly stained.

Walnut.—This wood requires filling, but before filling a stain must be applied. Also there is often sappy places that must first be touched up with the stain, after which the whole surface may be stained; the latter will remove a part of the touch-up stain, and blend it in with the whole. Touching-up is done with a fine camel hair brush. Use water stain. Walnut does not become so fuzzy as mahogany on being treated with water stain, yet there will be some fuzz,

and this should be sponged off, dried, and the fuzz sandpapered, as in the case of mahogany. Then the staining follows. In the furniture factory this sponging and sandpapering should be done in the cabinet department, because it will save on cost of production; for if the article be done perfectly smooth in the woodworking room the work will all be undone if sent to the finishing room to be sponged and sandpapered. Stock that does not need sponging before staining should be sandpapered afterwards and before filling. For the finest grade of work apply a thin coat of shellac—one pound of gum to the gallon of alcohol—before sandpapering; this will hold the fuzz so that the sandpaper can cut it off, and without going deep enough to give the surface a faded look. Let the stain have ample time for drying before applying the shellac, or the fibers of the wood will shrink after the filling, and leave pores unfilled.

There are several sorts of filler for walnut. Here is one that does not discolor the wood very much, and that produces the finest finish; at the same time it is a very simple one. Take equal parts of boiled oil, turpentine and japan and mix with rye or wheat flour, colored a trifle with burnt umber; run it through a hand mill. Another formula reads as follows: Mix together equal parts of black japan, brown japan, and raw or boiled linseed oil; to one gallon of this liquid add one pint of turpentine. Add to this combined liquid enough floated silica and Vandyke brown—at the rate of one part Vandyke brown to six parts silica, to form a dough. As it is desirable to have a very dark pore in this wood it may be well to add enough drop black to make it darker; but this is a matter of choice, as some do not like too dark a pore. If you wish to make walnut dark, do not try to produce the effect by adding more of the coloring matter you

are using to your stain. That will overload the stain and produce a muddled effect, clouding the fine marks of the wood. Years ago, when walnut was the supreme cabinet wood, it was darkened to the point of being ebony.

Some finishers urge that when an oil stain is used with a paste filler it is doing more than is necessary, saying further that an oil stain fills sufficiently itself, in addition to staining. Yet others practice the reverse of this method. One particular objection to the oil-stain method is that when you come to rub off the filler some of the stain will come with it, leaving the result about what it would have been without the stain. The walnut paste filler gives a more natural wood appearance than where oil or water stain is also used. Moreover, the dropping of the staining work decreases cost of production by that much.

When an oil stain is used with a paste filler it is a little darker than when the filler is used alone. This is well enough where the demand is for rather light walnut finish, as it is at this writing, for the dark brown of the stain is not satisfactory. However, either the oil stain should be used without the filler, or the filler without the stain. There are two kinds of walnut paste fillers, the one intended solely for filling the pores, and the combination of stain and filler. The former should contain no liquid coloring matter nor any coloring matter that is soluble in oil. Use either drop black or Vandyke brown, or the two combined, ground in either oil or japan. The filler base should be finely pulverized silica. To stain the combination filler when a brown tone is desired, use asphaltum of black japan to color the liquid, which will stain the wood, the black and brown pigments being used to color the silica; the amount of color to be used will depend upon the depth of color desired to

show in the pores. Combined stain and filler does best on walnut having a positive figure. Fine veneering should not be stained, but be filled with a filler having color in the pigment only.

A filler that will give a little color to the wood in addition to darkening the pore: Mix together two parts of raw linseed oil, one part of brown japan, and one part of black japan; to a gallon of this add one-half pint of turpentine. The latter will render thorough admixture of the liquids easier and more complete. Then add two parts of fine silica and one part of Vandyke brown to form a dough; thin down for use.

The following formula gives a good brown stain: Walnut crystals one-half ounce, dissolved in one quart of water. If it is desired to get a darker brown with this stain, use this formula: Walnut crystals one ounce, nigrosine (ebony powder), soluble in water one quart. This will darken the brown shade without increasing the depth of color. And the proportions may be varied to give any desired shade of brown.

A filler containing japan will soon become hard, hence only sufficient should be made at a time for the work in hand, though all filler should be made at least a day in advance. When filler is too long made it is very difficult to work, if at all workable. Make the filler into a stiff dough, and when wanted for use reduce what you need with benzine or turpentine.

If your filler does not dry as quickly as it should do not add more japan to it, but add just a little more silica; do not add too much, for that would weaken the mass. If you are using some old filler that works too hard try this plan: Stir into raw linseed oil silica and Vandyke brown, in the same proportions as used in the filler formula, to form a dough; add enough of this to the old paste filler to make it work easy. By

dough is meant a condition like that of the baker's unbaked loaf.

A filler does not need to be made so stiff as to be hard-working, for it is certain that it may be in a condition that will admit of easy rubbing, without leaving the pores unfilled. Filler that is too stiff is likely to pull out of the pores. It is quite possible to make a filler that will rub easily two hours after application and dry hard within twenty-four hours.

White Pine.—This wood is soft and close-grained. White shellac affords a good first-coater, sealing the pores or grain of the wood, and not greatly altering its natural color. But when the wood is rather uneven of color it is better to add some coloring to the first coat, just enough to make the surface uniform. Sometimes this wood is treated with stain, and often it acts badly, due to the fact, as some say, that the wood contains tannin, and that the same is true of yellow pine. However, only very light colored stain is ever thus affected.

Knots that are objectionable may be treated with this bleach:

Chloride of lime	17¼ oz.
Soda crystals	2 oz.
Water	10½ pts.

Lay this paste on the knot and let it remain there for a few hours; then remove it, and if not sufficiently bleached repeat the operation. Or if bleached enough, neutralize with acid.

Oil as a finish on white pine does not do well, the effect being a cloudiness and discoloration in time. If the wood should be desired for exterior use, exposed to the weather, then oil would be useful, no doubt; it has been suggested by a finisher that two parts oil and

one part turpentine would be better than all oil. But shellac is the most satisfactory primer and surfacer of all. It keeps back any sap or rosin from coming through, except in extreme cases, and especially when a light stain is used. Two coats are best, each rubbed down with fine sandpaper, followed by two or more coats of pale finishing varnish.

The surface of this wood must be made smooth and free from all blemishes, all pencil or other marks carefully removed. The more perfect the surface the finer the job. And it is better to make the wood smooth with the plane than with sandpaper, which will cause scratches, no matter how well done.

Hard Pine.—This wood is variously named, according to its source; some of its names are Norway pine, Georgia pine, red pine, Southern pine, etc., as well as hard pine. But the pine is not always a hard pine; as a wood it is classed among the soft woods. The dark, rich red pine, that we call hard pine, is hard mostly, according to its distribution of hard sap or rosin; when the tree has been bled of all its rosin the wood is not so hard. Its color ranges from light sapwood to an orange-colored heart. Hence the wood is a rather difficult one to finish. Its surface may contain soft places that will absorb like a sponge, and at the same time have parts so hard as to repel stains and filler or surfacer. Yet it is a "soft wood."

This wood is largely used in house construction, and this includes trim, flooring, etc. It is seldom finished with paint. It does not take paint well, besides which it has a good figure and growth or grain, and also good color, hence finishes very well with varnish, etc. Sometimes the finish is simply brown japan, well rubbed into the wood, two or more coats, each coat being rubbed off with a cloth, to show the grain, and leaving color in the wood. Another and similar

method is to apply the japan and rub off, as described, then to apply a coat of the japan and let it go at that. Such a finish has nothing to recommend it. Again, the japan may be applied to the bare wood and is done.

Painters often finish hard pine with liquid filler and hard-oil finish. School furniture made of this wood is sometimes sized with glue, on which a coat of varnish is applied, followed by another coat of glue, and finally a coat of cheap copal varnish. Often the furniture gets but a coat of glue and one of cheap varnish. Orange shellac gives some color to the wood, if the wood be deficient in that respect, as some sorts are, and also has better body than the white shellac, hence is to be preferred where economy is an object.

It is rather difficult to stain this wood without hiding its grain. The use of aniline stains is not advised. An architect wanted a black walnut finish on hard pine; it was discovered that Vandyke brown did not give the desired color, so black was added to it and the result was satisfactory, a very dark walnut color. The wood must be perfectly dry when you are about to stain it, and the room should be warm, about 72 deg. If the wood is to go against a cold or damp wall, paint the back of it two coats at least. This may prevent mildew, which comes from dampness.

If the room you have to stain and finish shows several kinds of wood, or if the one wood is uneven of color, with sap and streak, apply a thin coat of shellac, and stain over that, using oil stain.

To do a job of hard pine proceed as follows: Clean off all marks, dirt, etc., and sandpaper smooth, dust off and apply a coat of white shellac. Right here another workman says that before the shellac is applied there should be given a very light coat of light paste filler. It may be explained that there are usually some soft or open parts that thin paste filler would make

more solid, and hence the use thereof is advised. In rubbing off, the filler that lies on the hard parts will come off entirely, but that over the soft parts will be pushed into the wood, the rest being removed in the rubbing.

After the surfacing has dried, fill all nail holes, etc., with putty made from oil, white lead and dry whiting, with a little ocher to color it. Then rub off lightly with fine sandpaper and apply a coat of shellac. Finish with a good grade of pale finishing varnish, reduced a little with turpentine. But use your own judgment about that. In forty-eight hours rub lightly with oo sandpaper or steel wool of corresponding fineness, or even with curled hair; dust off, and apply another coat of the pale finishing varnish, but unthinned. If a rubbed finish is desired, or a polish, give three coats of varnish, rubbing off the gloss of the last coat with flour pumicestone and oil or water, and then polish it.

Good results can be secured from the following method: Use a stain made from the necessary pigments, with sufficient driers, and benzine or turpentine thinners. Let the stain stand a while after application, then wipe off clean. Should this not give the desired color, glaze over it with the color you wish, using a thin glaze. The glaze must be carefully applied and blended, to secure a uniform coating, and it must, of course, be transparent. The point in staining is to get the color effect desired, without impairing the natural beauty of the wood.

Whitewood.—All white or very light colored woods are more or less discolored by linseed oil. The best primer and surfacer is white shellac, though some finishers claim that white Damar varnish is better, as it is whiter. But it is a very soft gum varnish, and though shellac goes on top, yet it is never safe to have a soft coating under a harder one. The shellac when

dry must be well sandpapered with fine paper, and then another coat be given; these two coats may be applied in one day, on hurried work, but it is better to allow more time than that, two days at least. Usually four coats are applied, the last coat rubbed down with flour pumicestone and water, rubbing very lightly. Such a finish gives a level, smooth, solid and deep-appearing effect.

FINISHING WESTERN WOODS

The following are brief specifications for finishing Douglas fir and other Western woods.

For natural finish, dull, two coats of raw linseed oil, well rubbed in. Flat, one coat of raw linseed oil, one coat of white shellac, and one coat of flat varnish. Gloss, one coat raw linseed oil, one coat white shellac, and two coats of bright hard varnish. Wax, one coat of raw linseed oil, two coats of prepared wax, well rubbed in with cloth, or weighted brush, for floors.

If to be stained, then substitute the stain for the oil coats given above. Do not use orange shellac on natural shade or light stain finishes.

Many fine effects may be obtained by using oil stains, as they bring out the grain of the wood more prominently. Apply a coat of penetrating stain with a soft brush, then wipe it off when set, using a soft rag. It may be necessary to go over the work with a little color to tone down to match the darker parts. After drying for twelve hours apply one coat of white shellac, for light stains, and orange for darker stains. When dry rub down with fine steel wool, dust off and apply a coat of rubbing varnish. Then another coat of rubbing. The finishing coat of rubbing or polishing varnish may be applied when the second coat is dry, and when hard enough it should be rubbed with curled hair.

For a gloss finish, after forty-eight hours rub with pulverized pumicestone and oil, using a felt pad. For polish finish rub with powdered pumicestone, oil, and felt pad, and polish with rottenstone and oil. The

work should be done in a dry atmosphere and at a temperature of about 70 deg. F. Avoid over-staining.

The best results for red cedar may be obtained by the following method: Apply one coat of good clear liquid filler, finishing with two or three coats of varnish. Rub down with fine steel wool between each coat, and the last coat of varnish can be polished with rottenstone and oil if desired. Particular care should be taken with cedar, as it is easily scratched.

To finish outside doors, porch panels, and outside work that is to be done with varnish, and which work is exposed to the weather, the following method is advised: Make the surfaces smooth, then apply a heavy coat of boiled linseed oil which contains a good drying agent. Allow this to thoroughly saturate the wood; it is intended to prevent absorption of oil from the varnish. After the oil has dried sufficiently apply two coats of exterior varnish, rubbing between each coat, polishing the last coat with pumicestone and oil. If to be stained, apply stain first.

Some Woodfinishing Notes

Weathered oak, mission oak, and fumed oak are sometimes classed under the same head. The first is a stained wood, while the other two are fumed, and then finished with either lacquer or shellac, with wax finish. Early English oak is similar in type to weathered oak, but it does not have to be filled; weathered oak is simply stained and shellacked or waxed. Some shellac before filling, and then give it a dull-rub finish.

There are some thirty different shades of weathered oak, and fifty shades of early English oak, varying from bright umber to almost green. The best results for early English oak may be produced by first staining, and then applying a very thin coat of white shel-

lac; then fill, shellac, and finally varnish and rub to a dull finish. Some do not put on any varnish, but simply apply two or three coats of shellac, so as to avoid much rubbing.

Butler oak at first meant a gray-brown, but it has no standard color now, as everybody makes his own color, running from a gray-brown to a red, or even to a green cast.

Jacobean finish is much after the old sixteenth century finish, which was made by staining with a reddish-brown with a slight purple tone; it was allowed to stand about a half hour, then it had its high-lights wiped out with a rag, to give the appearance of having been worn or rubbed off from years of use; this effect was particularly shown around doorknobs, handles, escutcheons, etc., but that has been done away with. The process has been cheapened by doing away with all the rubbing that was required, and making the finish uniform and coating it over with shellac and wax, or two coats of shellac and no wax. In cheaper grades of furniture it is brownish, much of an umber cast, and it is being finished without a filler.

The Adam brown mahogany stain is one with a brown cast and a slightly red undertone.

Kaiser gray and silver gray differ only in the cast. Kaiser gray has a blue cast, while silver gray has a green cast. The latter is made by first staining the wood and then, if a fine flake is desired, in either Kaiser or silver gray, after staining it, first apply a very thin coat of white shellac, then fill it after the shellac is dry, with a white filler. If you wish a gray overcast throughout first stain and then fill over the stain.

Kaiser gray might properly be called a dark shade of silver gray; they both may be made from the same materials, with a stronger solution for the former.

There are many different shades of each. With the following formula it is easy to prepare any shade of gray that may be desired. Mix together in powder form one and one-half ounces of sulphate of iron, four and one-half ounces of sulphate of soda, and three-quarters ounce of jet black Nigrosine. Dissolve in six quarts of hot water; apply and when dry apply a coat of white shellac. For a durable finish, one not affected by a damp climate, finish with a thin coat of white shellac and two or three coats of banana oil. Then wax in the usual way, having added to the wax some zinc white, and clean up so that the white wax shows in the pores only.

Many finishers fill the surface of mahogany with oil stain; better results can be had by first applying a very thin coat of shellac. It is important that the wood be perfectly dry, otherwise there can be no assurance of a good finish. Mahogany filler should not be used the same as oak filler; benzine should not be used, as that will injure the color of the wood; it will bleach it at once, changing the color of the filler on the surface and in the pores of the wood; it injures red or any bright color. Where benzine has been used in connection with filling mahogany you will see its bad work by looking over the face of the wood; you will find the pores of the wood have turned gray or more pink; that is caused in almost every case by the use of benzine or by damp lumber, but mostly by benzine.

Very much of the Circassian walnut that the people get to-day is simply gum. Or part of the furniture they buy for Circassian is gum. But very fine imitations can be made with gum. All gum wood, unless quartered, is not figured, so that in order to make a perfect imitation of the Circassian walnut the furniture maker uses a charcoal crayon to mark in the lines

found in the Circassian wood, and after that he will paint them in with stain, or he will use both, and you will see both in some cases, though it will be rather difficult for the inexpert to discover the deception.

Circassian walnut requires a stain that will not penetrate the wood, and hence it is necessary to use a very quick thinner, such as benzol, or varnish, or anything that will do what is required and not hide or cloud the markings of the wood.

The finisher long ago learned that he could take furniture made of gum or maple and get the same result as with mahogany, by using the proper stain and handling it right.

Western yellow pine is known throughout its range simply as pine or yellow pine, and in the lumber trade of the Northwest as Western pine. It is sometimes called Western soft pine or, less frequently, Oregon white pine. The terms used by the California lumberman are "Western white pine" and "California white pine."

That cloudy or mottled effect so objectionable in yellow pine stained with oil stain may be remedied by coating it with a mixture of one-third raw oil, two-thirds turpentine, and a little driers. Let it stand until next day, then scuff it with No. o sandpaper; after which apply the stain. That will give a fine surface. It is to be done on the bare wood, not on the stain already there. The idea is to get enough oil on to stop suction, and as little oil as will do this. Oil or water stain may be used over this surface. The water stain should not be applied until after forty-eight hours, and apply the oil-turpentine-driers mentioned above.

FINISHING HARDWOOD FLOORS

THE finishing of hardwood floors presents no problem that is not met with in hardwood finishing in general, but there is one point not met with in other finishing that should be mentioned here. The floor is to be walked on, and hence its finish requires more time for drying before being used than any other part of the house. There are floor varnishes that can be walked on without damage within ten or twelve hours, say, over night. But this is not the point. The floor must have proper time from the filling; some people are so anxious to get into the new house that the floors are not given time for becoming sufficiently hard all through before being used. Even after a floor has been laid it should have time to "work and set," as the floor-layer will say. He adds that seven or eight days in a warm room will be sufficient time. But will the floor get that much time? In the meantime the floor must be covered to protect it from injury. A good floor will be scraped and sandpapered. A machine is used for the purpose, using No. 1½ sandpaper for the first cutting, and finishing with No. 00 paper, which gives the wood a sort of polish. First the machine runs across the grain, then with the grain; this will leave about six inches around the sides that must be done with a hand scraper, finishing with sandpaper and block. Then the floor is cleaned off, the last sweeping being done with a broom having a flannel cloth tied over it, the latter slightly dampened with raw linseed oil, which will take up the dust left from the previous sweeping.

The clear grade of oak flooring should be filled with uncolored paste filler, or with a little oak color. Select and sap grades should have a light golden oak filler, and after the floor has been filled it should be gone over with a little burnt umber, to darken any light streaks. Thin the umber with turpentine. This will make the select and sap grades look like clear grade, excepting that they will be slightly darker in color. In filling No. I-common grade, a dark golden oak filler should be used, and the light streaks should be darkened as previously described. If the floor-layer is a little careful in laying this grade fine results will follow.

After filling the floor give it about twenty minutes to set, then rub off with burlap or tow, across the grain. Let the work now stand for twenty-four hours, then sandpaper smooth and apply a coat of surfacer, an article described in another part of this work. Some use copal varnish thinned with turpentine. Sandpaper again, and for a good job give it two coats of rubbing varnish, rubbing the first coat to remove the gloss, then rub the second coat with powdered pumicestone and water. Clean up, let the work dry, then apply wax or varnish, as desired.

Wax Finish.—Take cheese-cloth and double it, and make into a bag, in which place some powdered wax and go over the floor with it. The wax will work evenly through the meshes of the cheese-cloth, preventing too much wax in a place, and preventing any waste. Wax polish may be used in place of the dry if desired. This done, rub to a polish with a weighted brush, first across the grain of the wood, then with the grain. To get a good finishing gloss follow the weighted brush rubbing with a piece of felt or carpet under the brush, going over the work with it. A second coating of wax may then be given, after the first coat has had an hour to dry.

Varnish Finish.—Varnish is, of course, a more expensive finish than wax, but it is more serviceable, giving a hard and yet elastic surface. The wood is paste-filled and two or three coats of varnish are applied, each coat being rubbed with pumicestone powder and oil. That is for a first-class job; one or two coats of varnish are sometimes given.

Finish for Hard Pine Floor.—Shellac finish is usually the best for a hard pine floor, as copal varnish does not wear well; it does better when applied over shellac. Some finishers say that neither shellac nor copal varnish should be used, but that the wood should be stained with a dark oil stain, wiped off, and then, when dry, have a coat of equal parts of raw oil and turpentine. This should be wiped off dry. First wipe across the grain of the wood, with the dark oil stain, the wiping taking the stain from the hard parts and putting it into the softer parts; finally wipe the surface dry with a dry clean cloth. Repeat this operation until the wood will take up no more. A hard pine floor treated this way will neither scratch nor wear off in spots, and it is easily renewed when that becomes necessary. Such a floor does not become slippery, and it grows more attractive with age, the color darkening and mellowing.

If to be finished natural you will first apply a liquid filler, pale of color, or a coat of white shellac, following with copal varnish, pale, or with wax; or two coats of shellac.

There is some difference of opinion among experts respecting the use of a filler on wood before waxing; in its favor it may be said that where shellac has been used, with wax over it, when you wish to clean the floor and renew the finish it is easy to remove the wax with turpentine; but if the wax is on the bare wood, as some prefer, it is a more difficult matter. When the

wax has been washed off clear down to the shellac you will have just as good a surface to wax on as when the floor was first done.

Finishing Hardwood Floors.—Work upon the principle that for good wear apply as few coats as possible. A floor laid with oak or other open-pore wood should be filled with paste filler; never use a liquid filler for this purpose. Finish with copal varnish or shellac, or with wax. Some finishers give the floor two coats of thin shellac and call the job done. Others will prefer two or more coats of good floor varnish. But a majority of finishers will vote for a wax finish, in some cases applied over the filler, but more commonly after a thin coat of shellac has been applied over the paste filler. The prepared wax is applied with a weighted brush, and the polishing is done with the same tool, with felt or carpet under it. Beeswax itself is quite soft, so that the commercial waxes usually contain some harder wax, which admits of a better polish. Carnauba wax is used with ceresin or beeswax for floor polishes.

Wax Floor Polish Formula.—Take three pounds each of ceresin and carnauba waxes, shred, and place in a suitable vessel; place this in another vessel containing hot water; when melted add very gradually turpentine three gallons, stirring the mass frequently until perfectly uniform and with the consistency of vaseline. Then remove the vessel from the bath and pour into suitable containers for handy use. When perfectly cold the wax should be like stiff butter.

Polishing Hardwood Floors.—There are machines for polishing floors that have been waxed. One of these has something of the appearance of a lawn mower, having a revolving brush at the front to distribute the wax solution as it drips from a vessel immediately above it. This is followed up by a series

of reciprocating brushes that do the polishing, and another arrangement consisting of two hinged boards, arranged in the form of a triangle; this is worked over the floor, to and fro, by means of a long handle; provision is also made for clipping cloths on both boards, enabling one side to be used for distributing purposes, and the other for drying off and imparting a final gloss or polish. The tool used for small jobs is the weighted brush, made and sold for that purpose. A cheap, home-made device for the purpose may be made by screwing a number of scrubbing brushes to the bottom of a box, which may be weighted with bricks or other heavy objects, and pushed or pulled over the waxed floor.

Waxing Old Floors.—An old floor offers difficulties of several kinds, such as open cracks between boards, which will have to be made good by means of strips of wood; open joins, showing nails, dirty woodwork, etc. The cracks and other openings must be filled and the dirt removed. If the floor is stained with dirt it will have to be scrubbed with sal soda water and soap until clean. Stains can be removed with a bleach such as has been described under another heading. When clean and dry apply a coating of raw linseed oil, or equal parts of oil and turpentine; then sprinkle sawdust freely over the floor and sweep it well about, to absorb the oil; follow with a weighted brush, which will smooth and brighten the floor. After being freed from all sawdust and oil it is waxed and polished. If a first-class job is desired pulverized pumicestone or steel wool is used instead of sawdust, especially on hard wood.

Floor Wax Formulas.—1. A mixture composed of two-thirds melted wax and one-third turpentine.

2. A dry wax compound for dancing floors may be made from four ounces each of spermaceti and paraffin

and eight ounces of talcum powder, all worked together and passed through a No. 10 sieve.

3. Powder twenty ounces of stearin, five ounces of yellow beeswax, and two ounces of hard white soap; mix and sift together. For floor sprinkling.

4. Yellow beeswax two pounds, raw linseed oil one pint, and turpentine one quart. Melt together the oil and wax and add the turpentine later.

5. Shave fine one pound of white beeswax and boil with one ounce of pearlash in one quart of water. Stir until the wax melts and unites with the water.

6. Dissolve one-half pound of potash in a saucepan, on the stove; when water comes to a boil throw in one pound of finely shredded beeswax; stir well until the wax melts. Let it then cool; if too thick add more water. Apply with a paint brush, as you would paint, and with the grain of the wood; when dry, rub to a polish with heavy brush.

7. A cheap floor wax may be made from ceresin wax or purified ozokerite dissolved in kerosene oil on a water bath or on a hot stove-plate, but not close to the fire.

8. Another wax for dancing floor. Melt in 63 deg. benzine as much paraffin wax as the liquid will take up, then stir in talcum powder to form a fairly stiff paste; rub through a No. 10 sieve, then spread out thinly on trays, until the benzine evaporates. When the mass has become perfectly dry pulverize it and place it in tin cans with perforated tops, handy for sprinkling.

Floor Waxing Notes.—The waxed and polished floor is dangerously slippery, but if desired the wax may be removed, and again waxed when needed. This has reference to dancing floors, or large room floors in private residences used for occasional dancing. This

is the special excellence of a waxed floor, it can be made new at any time, and at little expense.

It is difficult to shred wax with a knife, but by heating the knife it is easy enough. Place the knife a moment in hot water, but wipe it dry before using.

The addition of from ten to twenty parts of rosin will make the floor wax harder. Or add some of the harder waxes, such as carnauba or Japan wax, these being hard but not brittle. Paraffin wax alone is too brittle, though it may be added to other waxes. It does not work soft like beeswax, but is short and crumbly. Some add japan driers to harden wax.

Floor wax may be colored, annatto being a good yellow coloring agent.

The secret of success with wax lies in applying it thin and rubbing it a great deal. Beeswax particularly should be spread very thin, for if too heavy a coating is applied it will show the shoe marks.

After applying the wax let it stand for an hour or so, in order to give the turpentine opportunity to evaporate.

A fourteen-pound brush is about right for the wax polishing; a lighter one will also do. After rubbing with the weighted brush let the job stand until next day, then go over it with the weighted brush again, with carpet under it.

Fresh made wax is better than one that has been made for some time and not covered close. The old wax is apt to be soft when upon the floor.

Crack Fillers and Floor Putties

Cracks in New Floors.—Melt two parts of common glue in fourteen parts of water, and stir in four parts of plaster of Paris and two parts of dry pow-

dered litharge. Prepare the glue by soaking in cold water until perfectly soft, then placing the vessel containing the glue and water on the stove until the water becomes hot enough to cause the glue to melt, then the other ingredients may be added.

Large Floor Cracks.—Boil newspaper to a pulp, then add wheat flour paste to make a stiff mass. Or add to the pulp glue size and some calcined magnesia to form a paste; color if desired. Or powdered dry litharge one part, plaster of Paris two parts, glue one part, water eight parts, cement four parts, sawdust two parts, casein five parts, water thirty parts, ammonia three parts, and dry lime three parts. Soak the glue in the water, add the other ingredients, and mix with the liquids, adding the thirty parts of water last.

Or make a putty with waterglass and whiting.

To glue size add asbestos powder to form a paste.

Mix one part of air-slaked lime, sifted, with two parts of rye flour, then add boiled oil to form a putty.

Dissolve four ounces of glue in two quarts of water by boiling; when done and allowed to cool, not beyond the warm point, however, stir in equal parts of sawdust and whiting to form a putty.

Mix together common putty, a little varnish and driers, and coloring if desired. This will make a hard, quick drying putty.

Paste wood filler makes a good crack filler; also a putty made from equal parts of whiting and white lead ground in oil, or whiting and dry white lead mixed with equal parts of turpentine, rubbing varnish and coach japan, with coloring if desired.

Putties and Cements for Hardwoods.—A very hard cement for filling defective places in wood may be made by melting one ounce of common rosin and one ounce of beeswax in an iron or enameled pan, and when melted stir in an ounce of any earth pigment that

will give the needed coloring, or color of the wood. This filler must be used fresh, while hot, for it will become like stone when cold.

Melt one part of good cabinet glue in sixteen parts of hot water, and when melted and cool stir in some hardwood sawdust and some whiting, to form a putty.

Make a putty of fresh pulverized lime one part, rye flour two parts, and raw linseed oil enough to form a putty. Or varnish may be used in place of oil. Color to suit the wood.

Add together equal parts of red lead, white lead, litharge and chalk, all dry, and mix with raw linseed oil to form a putty.

Cabinet makers' stopping or cement for wood is made as follows: Place a tablespoonful each of pulverized shellac and rosin and a lump of beeswax the size of a walnut in a suitable vessel, which set on the stove and let it remain until contents fuse. If the cement is intended for mahogany add a little Venetian red, for oak add yellow ocher or raw sienna, with a little burnt umber for darker oak. For ebony or rosewood add lampblack. Mix all well together. This cement is an old one, known as beaumantique. It may be used in the liquid state or be made into sticks like sealing wax; for the latter make the cement into a dough and roll it out on a board and cut into sticks. To use, heat it with a candle and let it run onto the part you wish to cement or fill, then level it off with a chisel and make smooth with sandpaper.

If you have nail holes or other places to fill defer it until after the second coat of shellac or varnish has been applied. The idea is to have the true color of the finish to match with the putty. Usually it is best to make the putty a trifle darker than the wood or finish.

In making putty for hardwoods or soft, whether the

work is natural or stained, make white lead putty, as whiting does not give as clear a color as white lead does. Use dry white lead, mixed with boiled oil to form a stiff putty.

Renovating Old Floors

Cleaning a Natural Wood Floor.—Strew some white sea sand over the floor and some potash solution, made from one pound of potash and one pint of water. Use a stiff brush and scrub the way of the grain of the wood. Or use hot water and a good brown soap, with vigorous scrubbing; change the water often. Ink stains may be removed with oxalic acid or strong nitric acid.

Coal Oil Stains.—Apply a strong, hot solution of oxalic acid, and follow with soap and scrub brush and hot water; change water often.

Worn Maple Floor.—In course of time a maple floor will show signs of wear, appearing very unsightly in places of most use. If in very bad condition remove the soiled and worn spots with varnish remover, and when clean coat it with white shellac varnish. Such a floor should have attention and whenever there are signs of wear and accompanying dirt clean it and shellac it.

Soiled Waxed Floor.—The floor is sticky and gray with dust. Take a handful of No. 1 steel wool, dip this into turpentine, and with it rub the floor carefully, softening up the old stuff and with some cotton waste remove the same. Then give it a coat or two of wax and polish it.

To keep a waxed floor in good condition go over it once a week with a mixture of equal parts of turpentine, sweet oil and vinegar, using a soft cloth. Then polish it with a clean, soft cloth, or with it wrapped around a floor brush.

Renovating an Old Floor.—If the floor has been paste-filled and finished with wax or varnish the best thing to do is to get all the old stuff off down to the filler, with varnish remover, or with steel wool if that can be done. If you use varnish remover be sure to first fill all cracks and crevices with putty, to prevent the remover from getting into the filler and afterwards coming out and injuring the finish. Both turpentine and benzine will cut or soften wax so that it can be removed. Bare spots in an otherwise good floor can be touched up with shellac or varnish.

Discolorations from Soap, etc.—To make a floor look bright and new when badly discolored from any form of alkali is a problem not easy of solution. Coarse powdered pumicestone and soap powder, or the prepared powder containing soap and fine sand or other suitable abrasive, with hot water and scrubbing brush may do the trick. If this does not remove the worst spots try dilute oxalic acid, four ounces to three parts of water.

Bleaching Old Oiled Floor.—The floor that has been oiled and that has become dark with age may be treated with varnish remover to cut out the oil, after which apply a bleaching powder, or for dark parts strong solution of oxalic acid. Try the acid first, and if it does not work then try the bleaching powder, which is very caustic.

Re-Varnish a Floor.—First remove all heel marks and scratches; maybe a rub with oil will cause them to disappear; if not, then sandpaper them until they are gone. Then give a coat of varnish.

Renovated Floors Need Cleaning Off.—When a floor has been cared for, cleaned and touched up, year after year, it will become too full of material to wear well, and it should be cleaned off with steel wool or varnish remover, whichever you believe will answer

the purpose best. Clean off clear down to the wood, and build it up as if new wood.

A Cleaned-Off Floor Not Durable.—A re-cleaned or renovated floor will not last as well as a new finished floor. This is partly due to the necessary use of chemicals in the cleaning-off process, which may remain, to some extent, in the wood and injure the finish. After using varnish remover clean up with sal soda solution, and follow this with plenty of clear water, also a vinegar size, to neutralize any remaining alkali.

Touching up Old Varnished Floor.—Touch up all bare spots with quick drying flat color, made to match the old floor color. Use japan color, adding only enough to stain the floor varnish.

Caring for the Floor.—Hardwood floors require attention not less than twice a year. They should be polished that often, with frequent wipings in between times. Use a soft cloth. Remove mud stains with water and soap and cloth; do not use soap too freely. Be careful with benzine when trying to remove stains. If gasoline fails try oxalic acid.

Grease on Parquetry Floor.—Rub the spot with soft soap, rubbing vigorously; then pour a little alcohol over it, light the alcohol, being careful not to let it burn the floor finish. Then scour the spot with hot water, repeating this several times.

Grease Spot on Waxed Floor.—Cover the spot with turpentine and let it remain on for one or two hours, if it will not evaporate in the meantime; in that case pour on a little more. Finally cover the spot with talcum powder and press it with a warm iron. Then brush off the talcum, and if you find the wax gone rub it with wax; but if the wax has not been affected then repeat the process.

A Few Minor Floor Notes.—There are commer-

cial oils intended for keeping varnished surfaces in order, they being about the same as the revivers or polish formulas which are given in this work. They are used by housekeepers, using a mop for the floors, the mop being made slightly wet with the oil. Then they should follow with a dry cloth and wipe up and polish the floor, though this is not always done.

What is known as floor oil is intended to keep down the dust in stores or other public places, and such oils are made commercially, with about the following formula: Take pale paraffin oil of medium body and heat it gently; to each gallon add one pound of previously melted hot paraffin wax of a melting point of not lower than 130 deg. Fahr. Be sure that the oil and wax are well combined. The oil is applied with a long-handled brush, and is allowed to soak into the wood.

Another formula for floor oil: Beeswax eight parts, water 56 parts, carbonate of potash four parts; dissolve the potash in twelve parts of the water, heat the wax and the remainder of the water together until the wax is melted, then mix the solutions and boil until emulsified.

Still another one: Paraffin oil eight parts, kerosene oil one part, lime water one part. Mix.

A preparation for sprinkling over floors before sweeping them may be made upon this formula: Sifted sawdust one-half bushel, salt two pounds, crude naphtholine four ounces, and carbolic acid two ounces; mix well and add enough cottonseed oil to slightly moisten the powder.

It is the opinion of many good workmen that it is wrong to shellac over the filler if you intend varnishing the floor; the shellac is too brittle, and it will not allow the oil varnish to penetrate into the wood and so get a good hold.

If you stain an oak floor gray do not apply oil varnish over it, for the oil will alter and spoil your gray. Some say that if you stain gray with logwood and vinegar stain the gray will remain gray under varnish. But the varnish must be a clear one; still, it will slightly yellow the gray. A case is on record where a very white bleached shellac varnish was put on gray-stained oak, and it slightly altered the color. A thin white glue size before applying shellac or varnish seems to be the best thing to prevent the altering of the gray.

To remove an oil stain from a hardwood floor, use a mixture of benzole and benzine, equal parts.

Douglass Fir Floor Finishing.—New floors of Douglass fir or hemlock should be dressed off with the hand-plane and well scraped. This is essential to good results. When clean apply one coat of a good paste filler. The filler should be thinned down with raw linseed oil and benzine (mixed ratio 1 to 3), and allowed to thoroughly penetrate the wood. Any filler which remains on the surface should then be wiped off with a dry cloth and a coat of white shellac applied. The first coat of shellac should be thinned with denatured alcohol, allowing it also to easily penetrate the wood. The floor should then be gone over with a very fine sandpaper. Finally two coats of shellac are applied, sandpapering between each. The second coat should be heavy and the last as heavy as can be worked. This process is for the very best class of work and gives a highly polished floor which will wear well. The use of a wood filler may be omitted on floors where the wear is not severe. It gives body, however, to the finish and will more than repay the cost and labor.

A second method is as follows: On the prepared floor apply a light coat of filler, rub down with fine steel wool to remove any excess filler that remains on the

surface, then apply one coat of good quality floor varnish and rub down with fine steel wool. To finish in gloss give two coats of best quality varnish. If a dull finish is desired, rub down the last coat with fine pumice. For a wax finish apply one coat of prepared floor wax instead of two coats of floor varnish, and polish with weighted polishing brush.

To restore the original finish to a floor when floors become dull and show wear, go over the floor with a cloth dampened with benzine, then apply a coat of floor wax with a soft cloth. Orange shellac should not be used as a finish as it darkens the floor. The above floor finishes are, of course, in natural colors. If stain effects are desired in floors, the stain is applied first before the shellac or finish coats are put on.

FINISHING VENEERED WORK

The veneer used in cabinet and furniture work is simply hard wood sawed or sliced (as there are different methods for producing veneers) into very thin pieces. These veneers are glued on to solid stock, and this fact must be kept in mind when about to undertake their finishing with stain and varnish, etc. Sometimes trouble arises from the grain of veneer showing after the finishing. Thus it will be seen that the workman must be both skilled and careful in order to produce good work on this kind of wood surface.

First of all we should understand what the veneering is. As previously stated, there is the sawed and the sliced; there is the rotary cut, plain, and the quarter-sawed veneer. Rotary-cut veneer, under proper treatment, finishes up practically the same as solid plain-sawed stock; identical treatment should produce the same result in both cases. Usually the raising of the grain of the wood after finishing is due to the wood not being dry when finished, either when finished at the machine, or in the hands of the wood finisher. Take a job of solid wood, for instance, and let the stock be put through the planer and sander before it is perfectly dry, and after it is finished with stain and varnish it is all too apt to "grain out." Some of the grain of the wood shrinks away, leaving the rest of the surface to stand as if raised. Hence, if built-up panels are sanded immediately after gluing and before all the moisture from the glue has dried out there will be a raising of the grain. Another probable cause of

graining-out may be found in the use of veneer that has been too loosely cut, or it might come from the using of rotary-cut veneer with the wrong side out. Where the blocks have been properly boiled and the pressure bar well fitted and carefully adjusted rotary-cut veneer is tight and smooth on the outside as it peels from the log, and is rather stiff to bend, as compared with loosely-cut stock, where the pressure bar is not doing its duty, or where the logs have not been properly boiled or steamed. Some veneer manufacturers indeed cut veneer one-sixteenth inch to one-eighth inch that is so tight and firm that it is rather difficult to tell the inside from the outside. On the other hand, there are those who cut it loosely, either from ignorance or carelessness, making a veneer that is simply a sheet of splinters held together by interlocking fibers. Veneer of this sort, as also veneer cut fairly tight but put on inside out, is very likely to show up bad in the finish. Or an excess of sanding on the face of a finished panel may cut away so much of the wood of the top layer as to leave what is practically the inside of the veneer and is not as tightly cut as the outside.

Preparing Mahogany Veneered Surface.—For water stain, so that the grain will not rise. One way is to lightly sponge mahogany veneered panels and tops with water, and allow the work to stand on end over night, to drain and dry. Then the fuzz is removed with a belt sander, or by passing it through a drum sander, covered with No. 00 sandpaper. Another method, followed in some factories, is to give the articles a thin glue size as they pass through a power-driven glue-spreader. By this method the grain is not only raised, but the resulting fuzz is left, hard and brittle, so it may easily be removed by fine sandpaper. If the grain is raised by some such preliminary treatment and then

cut away, the rest of the surface will remain perfectly smooth when water stain is applied.

Dyeing Veneers Black.—This may be done with logwood extract and yellow prussiate of potash, formulas for which see under the head of stains and staining.

Mahogany Veneer and Birch.—When these two woods are used together in the construction of an article use the same stain on the birch as that used on the veneer part, excepting that a double-strength stain is used on the birch. First coat the birch with the double-strength stain and, when dry, sandpaper if needed, then stain the birch and mahogany both with the regular stain. This will produce a uniform coloring and will not make the birch too dark. Fill the birch when you fill the mahogany. To prevent the filler from giving a cloudy effect coat with a very thin coat of shellac and sand lightly before filling.

Birch and Walnut Veneer.—To finish birch when used with walnut veneer, first coat the birch with a water stain. Walnut crystals may be used in making the stain. Dissolve in warm, not hot, water, and stir until they dissolve.

Finishing Walnut Veneer.—Unlike mahogany, walnut veneer is not stained, but is finished in almost its natural color. A little coloring matter, such as asphaltum or black japan, may be added to the filler, but that is all the coloring. If walnut and birch are together fill both at the same time, using the same filler. When dry, shellac and body-up in the usual way. Don't use a pigment surfacer on these finishes; rub to a dull finish, or polish, as desired.

Lines of Butt Joints do not Match.—It sometimes occurs that the lines of butt joints do not match perfectly, and this may be remedied by taking a camel hair brush and a dark stain and carefully filling in,

making wider or extending the lines as required. Do not over-do it, though.

Staining Veneered Work.—See that the surface is in proper condition before you begin. If it has not been sponged do it at once. Use clear warm water, and when it is dry sandpaper smooth with good sharp No. 000 paper, to remove the fuzz. Apply stain with a 2- or 3-inch brush. Apply quickly, to avoid streaks; cover the whole surface freely with the stain, and brush it out evenly. Brush with the grain of the wood. Unless the stain is applied freely there is danger of lapping, while other places will be under-stained, producing a streaked, faded effect. If the stain is too strong for this then reduce it. If you brush the stain too much there is danger of loosening any glue that may have found its way through the face veneer, and which would smear it over the surface, producing a murky effect. For the same reason water stain should not be wiped off veneered work. The presence of glue will be manifest in the slight foam of the stain.

Polishing Veneered Work.—After scraping up the wood, apply a coat of size, for stopping up the grain, let this dry, then apply whatever stain you wish, and finally proceed to polish it. Don't use too much oil. The polishing is the same as for all hardwoods, but for a filler use a size for dark wood, and plaster of Paris for light. Lime is best for darkening Honduras mahogany, chestnut, etc.

Protecting Inlay or Marquetry.—Where inlay or marquetry work is employed in connection with hardwood work it is difficult to avoid injuring the former in the filling or staining of the latter. One way is to protect it with shellac, but a better plan is to cover it with glue size to which has been added a little glycerine; just how much glycerine to add will depend upon temperature. Usually this size can be taken off

with a wet rag. But should it be difficult to do this, then try a scraper, which must be handled carefully to avoid scratching the wood. A workman in the Pullman shops gives this method: After filling the woodwork clean up the inlay or marquetry work with benzine and No. 0 sandpaper. I have no difficulty in cleaning up such work, but I never use a pencil on shellac. We use satin-wood exclusively for inlay work; there is no grain in this wood for the stain or filling to affect. "There appears to be a manufactured mahogany stain that will not discolor wood inlay, but will stain mahogany. If the furniture is composed of mixed woods it is necessary then to use an aniline stain in order to make uniform the different kinds of wood. And in this case it is necessary to trace the inlay with shellac or lacquer, using a very fine pencil or brush. Be careful to trace only the inlay and not get any of the shellac or lacquer on the wood; in case you do the stain will not take. The stain will stick a little on this shellac, but after the work is stained the inlay may be scraped lightly and bring back the inlaid colors without much work."

The foregoing is given without my recommendation, as I know nothing more than what the account gives—it should be very useful if its claims are correct. It seems improbable.

Penetrating Ebony Stain.—Nigrosine B, spirit or water stain, which has a blue-black undertone, is best for imitating ebony. Nigrosine black stain in solution with denatured 188 deg. proof alcohol that has been filtered will give better penetration than water stain. Weak stain will require more than one application.

There are other ways to produce ebony stain, but they are troublesome and out of date.

Veneer Finishing Notes

Stained veneer will remain lighter than solid wood. To overcome this apply a second coat of the stain to the veneer.

To prevent the darkening of cross-grained wood moisten it with water just before staining, which will prevent the stain from penetrating too deeply.

Crotch mahogany and burl walnut can seldom be improved by staining, but if it is desired to slightly deepen the color tone of the paler parts the stain should be very weak. The darker parts cannot be made darker by staining, and the more the lighter parts are darkened the more we reduce the contrast between the different parts; consequently the more we destroy the figure.

It is possible to save one cent a foot on some face veneer and find that when it is ready for rubbing, in the finishing room, it is so badly checked that an extra coat of varnish is required, the cost of which is about twice the amount of the first saving.

A good filler for veneered work will dry flat in from ten to twenty minutes, and will not work sticky when being removed. If it dries with a gloss there is either too much oil or the pigment has settled to the bottom of the can.

If reinforced panels used in building operations are given a coat of asphaltum on the back before being placed in position danger from dampness will be greatly reduced.

The liquids used in connection with thin veneers must be such as will cause the least harm to the glue joints. And those that are very grain-raising are not at all desirable, as the raised grain means heavy sanding or scraping.

For low grade veneer work stains composed of mild chemicals—those composed mostly of pure coal tar dyes—will give the best results. Stains containing acid chemicals will discolor the glue and the wood will show poor results. The work is made too rough by their use, and this renders too much sandpapering necessary.

Fancy veneers, crotch and burl, are usually improved by a coat of light stain—a stain merely dark enough to take away the faded appearance of the lighter parts—although many persons prefer to have these fancy veneers finished quite natural. The stain does not make the dark lines of the wood darker, but it darkens the light lines only. The figure of the wood depends on the contrast between the colors of certain lines. If these lines were all of the same color there would be no figure. From this it will be observed that the more we lessen the contrast between the light and the dark lines by making the light lines darker, the less distinct the figure becomes. It is not thus with all woods; the figure of some wood is made by irregular grain; that is, part of the surface shows a straight grain, part cross grain, and part will show considerable end wood, but the whole surface will be uniform of color. On such wood, up to certain well-defined limits which may be ascertained by experiments, the darker the stain used the more distinct the figure becomes, as the stain acts more powerfully on certain parts, such as the end wood, than on others.

The checking of veneered work when being rubbed may be caused by one of several different defects. Perhaps the fiber of the wood was ruptured during cutting, the veneer may have been laid wrong side up; it may have been laid before being made dry; it may have absorbed moisture from the glue before the pressure was applied. At any rate the checks are in the

veneer before the rubbing is done, and probably before the varnish was applied. See to it that the veneer is sound, perfectly dry, and laid right side up and placed under pressure before it can expand as a result of moisture from the glue.

WOOD STAINS AND WOOD STAINING

The stains used in wood finishing are obtained from both vegetable and mineral substances. In the former class are the roots, barks, woods, and plants that are rich in coloring matter, and with all of which we shall become familiar further on. In the mineral class are sienna, umber, etc., and which are the most durable of all colors. Then there must be included with the mineral class the chemical colors, such as Prussian blue, lampblack, green, etc. Then, of more recent use, we have the coal tar dyes, more commonly known as aniline dyes. These are more fugitive than either the mineral or vegetable dyes, as a rule. Some anilines now are made faster to light than formerly, and in time we may hope to see the whole list light-proof. While the vegetable and earth pigments are more durable than the anilines, they are not wholly light-proof, being liable to fade more or less in time. Much depends upon the direct exposure of the pigment to the sunlight for its stability. And when covered well with some suitable coating, such as a varnish, for instance, sunlight has very much less effect upon it. At the worst, such stains will endure without serious decay for a long time, while the anilines will often fade badly within a few days. A house whose woodwork was stained a mahogany color with aniline dye faded very much before the house was finished. Olive color aniline stain has been known to change to a dirty reddish-brown in a short time. Yet some of this instability of color may be attributed to the wood, which may and in some

cases certainly does contain certain substances that alter and injure the stain.

Vegetable and mineral pigments are usually prepared for use with water, but in some certain cases they may be used in oil or turpentine; in either instance the first object is to extract the coloring matter, when possible, as it always is with vegetable colors, and sometimes with mineral colors. For staining wood it is most desirable to have the color extracted, which gives the most transparent dye, but where this is not possible, as with the mineral pigments, or where it is practically so, the stain must be used as thin as possible, and then all surface color be wiped off. In this respect the anilines are more useful, for they sink into the wood's fiber, thoroughly impregnating it, while leaving the surface colored, but not covered, nor affecting any figures or grain of the wood.

Water stain is more penetrating than oil stain, and is very desirable and satisfactory, but it has the serious fault of raising the grain of some woods. Water stain also gives a more solid coloring, as it carries its pigment into the wood, while oil stain retains some of the pigment, and thereby gives a less opaque effect. Oil stain brushes out well on soft woods, water stains do not. Turpentine stain is absorbed too quickly for equal distribution of coloring. On hard wood oil stain does not penetrate as well as water stain. Turpentine carries the color well into the wood, but is more costly than water, though not as costly as linseed oil. We speak of prices prevailing as we write.

The best mineral or earth pigments to use with oil are Vandyke brown, burnt and raw sienna, and the two umbers, burnt and raw. These pigments must be ground butter-fine and of the highest grade. While both the mineral and chemical colors are suitable for

use in oil staining, most of the vegetable stains are not. Of these latter may be mentioned turmeric, gamboge, dragon's blood, etc. More will be said upon this subject further on.

Most of the anilines employed in wood staining are water-soluble, and the oil-soluble anilines do not interest us. We may sometimes require aniline that is alcohol-soluble, useful when a spirit stain is required. We have that, too.

Anilines must not be placed in metal vessels, but in glass or porcelain, or glazed vessels.

Where the stain is used daily or at more or less frequent intervals it is well to make what is called a stock solution. Place an ounce of the aniline in one quart of hot water, pouring the water over the aniline, stirring it with a wooden paddle. Soft water is the best for the purpose. Water containing lime or other mineral water is apt to injure the aniline dye. After about an hour the dye may be strained through raw cotton, placed in a funnel in the neck of a bottle. Use a glass, porcelain, or other non-metallic funnel. Cork the bottle tight, and label it with the name of the dye and its strength of solution. When wanted for use pour out a measured quantity and dilute it with a measured quantity of hot water. The rule is, an ounce of aniline to one gallon of water. So that the stock solution mentioned will bear three more quarts of water, and in this proportion when pouring it out for use.

To save what dye remains in the cotton in the funnel remove it and soak it in a little hot water, just enough to take up the dye; this done place the dye in another bottle and label it accordingly.

In this way there is no waste of dye, as there must be in daily mixing, and you may have an assortment of stock dyes of various colors on hand, for ready use.

And they will remain good for quite a long while, if not used.

To prepare aniline with alcohol place one-half ounce of the dye in a vessel, as previously directed, and pour over it one quart of alcohol; shake it occasionally for a few hours; then filter it into another suitable vessel, and finally filter it into a bottle, which label as before directed. While it is not really necessary to filter this, it will perhaps be as well, and certainly will do no harm. For filtering it, use filter paper, and place a saucer over it, to prevent evaporation as much as possible.

Remember that both water and alcohol aniline stain must be applied very swiftly and deftly, in order to secure uniform coating of the surface of whatever object you have in hand, the larger and wider that surface the more difficulty in the staining and the more need of care. Spirit stain is especially difficult on account of its quick setting, and only the expert may hope to accomplish the work with perfect success. Many prefer a small sponge for applying the stain; others choose a flat, wide, soft bristle or hair brush. Immediately the stain has been laid it should be wiped off, if the figures of the wood are to be brought out well.

A stain may be made lighter by dilution and darker by applying two coats. Some woods seem to require two applications to appear at their best. Soft wood, that is to say, that which is soft in parts, or spongy, as it is called, should first have a very thin coat of shellac, then the stain. Some woods require bleaching first. Bleaching may be accomplished by a wash made from

Chloride of tin	8 oz.
Soda crystals	1 oz.
Water	5 pts.

Apply this, and after a few minutes give it a wash with dilute sulphuric acid, then wash off with clear water; let it dry, then stain it.

Raising of the grain of wood may be largely prevented by wetting the wood with water, which will raise all grain that is not fast; when this dries sandpaper off, and then when you stain with water stain there will be very little rising of the grain. A finisher says his plan is to first wet the wood with a mixture of benzine five parts, and raw linseed oil one part. This reduces the amount of raised grain, and at the same time prevents the stain from sinking in too far, thus giving a more uniform staining. These ideas of practical workmen are worthy of consideration. Some finishers add a little glycerine to a spirit stain, some add a little castor oil both of which are liable to cause trouble with the succeeding coats of shellac or varnish. About one tablespoonful of castor oil to the quart of stain is used; but the stain must have extra time for drying, on account of the non-drying oil, in case the finish is to be varnish on a filled wood. In the case of such finishes as Flemish oak, for instance, and which require neither filler nor varnish, the oil will do no harm, and a more liberal use may be made of it. However, it might be well to use, instead of oil, Venice turpentine, a tablespoonful to the pint of stain.

It has been pointed out that the nature of the wood that is to be stained must be taken into consideration, as woods differ in regard to their reception of the different stains. Take maple, for example, which can be stained gray easily, while oak will not give the proper gray color in most cases, since its color tends too much toward yellow, so that the gray stain, after waxing, shows a greenish hue. Light gray stain on oak is very apt to turn yellow, especially where the stain is not light-proof, such as the coal tar stains. All woods

stained gray with iron salts or other metallic salts, such as potassium chromate, copper sulphate, etc., take on a brown tone in course of time.

When mixing stains from anilines at the shop care should be observed to select light-proof colors, and where two or more colors are to be mixed together see that they are as near alike as possible as to their fastness to the light. For instance, if a brown stain is mixed from black, yellow and red, then the stained wood will gradually take on a much lighter shade than desirable if the red was less light-proof than the other colors. So with the mixing of any other of the fundamental colors, it depends on the preponderance of some color in the dye whether the final stain will have one shade or another. If in a brown color red is in excess the final shade will be reddish-brown. The modern greenish-brown shades similar to the fumed finish are usually mixed with green, and green deadens all colors. If too much of it is used the shade will have too deep a greenish hue, and then red may be used to offset the green.

Aniline dyes may be deepened in shade by adding a little potassium chromate or a little sodium hydroxide. Most colors may be made by using the fundamentals red, yellow and blue. Since the blues are, however, less light-proof than the others, they are avoided wherever possible, other colors being substituted.

It is impossible to get exactly the same color on a wood with the same stain. A piece of furniture will show considerable differences in shades in the various parts, a condition that is not very obvious in the completed object. But if these different parts were to be laid side by side a great difference might be observed. The reason lies of course in the natural difference of the wood itself. Oak, for example, shows such a dif-

ference even when taken from the same trunk or log that it is impossible to get a uniform shade over the entire surface. Arguments have arisen over this subject, the finisher claiming that a stain is at fault when it fails to stain two pieces of wood alike, when that is impossible owing to the fact that the grain and structure of the two woods, though of the same tree, is not the same. If veneering and solid wood form one piece of furniture, say, the veneer will always be lighter than the solid wood, and to overcome this it is only necessary to add a second coat of stain to the light part, using either the same stain or some oil or spirit stain. Darkening of cross-grained wood or carvings can be avoided by moistening the part with water just before staining, to prevent the stain from penetrating too deeply. To some extent the moistening of the wood will prevent irregularity of effect in staining.

All vivid stains containing alkaline ingredients or even potassium chromate should be avoided, as they fade rapidly under the influence of light and exhibit other bad features with lapse of time. For example, the chromate and the soda in the hydroxide destroy the shellac coating, and with very strong solutions of the chemicals yellow and gray spots appear after a time, and they are very difficult of elimination.

Coal tar stains have the disadvantage of leaving the pores in the wood lighter than the rest of the wood, but this can be remedied by waxing the surface after staining. Too much wax should not be used, as then the pores become too dark, and the surface of the wood takes on a dirty brown appearance.

Staining Oak

To Match Brown Oak.—When it is desired to match brown or pollard oak on common oak use a stain

made from one ounce of bichromate of potash dissolved in five pints of soft water; this is a weak solution, but strong enough for the purpose. Should it not be strong enough, use more of the potash. Apply with a soft sponge.

Weathered Oak.—Make a solution of equal parts of water and iron sulphate, or iron acetate. Or, dissolve bichromate of potash, one ounce, in one pint of water, and apply in alternate coats with the iron solution given above; each coat must be dry before applying the next.

Or, dissolve two ounces each of potash and pearlash in one quart of water; use alternately with a solution of either iron acetate or iron sulphate.

Take of powdered ivory black and Vandyke brown equal parts and make into a paste with alcohol, making a stiff mass, after which add a little shellac varnish, when it is ready for thinning with alcohol for use.

Add a little Bismarck brown to Nigrosine B, and dilute with water to form a stain. Or dilute with alcohol, which will prevent raising of the grain. The shellac serves as a binder to the stain, and gives a near-dead finish without further treatment. For red oak make a stain more on the blue-black order. An oil stain may be made from Vandyke brown and ivory drop black in oil, thinned with equal parts of oil and turpentine, or with the latter alone, or with benzine and a little japan drier.

Bog Oak.—Dissolve two ounces of permanganate of potash in one quart of boiling water; when cold add to it one ounce of verdigris that has been dissolved in strong vinegar or acetic acid. To deepen the color add more verdigris solution; to lighten, add potash solution.

To make bog oak on white oak dissolve an ounce of verdigris in one pint of ammonia water.

Mix with one gallon of 95 per cent. alcohol one pound of the best powdered Turkey burnt umber and two ounces of chemically pure chrome green, light shade; shake the mixture occasionally, and after twenty-four hours add one pint of shellac varnish, and strain all through a fine sieve.

Mission Oak.—Break up two pounds of drop black, ground in oil, and add one ounce of rose pink, in oil, with one-half pint of the best brown japan, thinning the mass with three pints of turpentine, then straining it through cheese-cloth. Japan colors will give a quicker-drying stain, but in this case omit the brown japan and use in its place a little varnish, to act as a binder. One gill of copal varnish will do.

Here is a similar process: Mix boiled linseed oil and asphaltum together in equal proportions; apply as a stain, with a brush. In a minute or so rub off with a cloth, removing the surplus stain, and then when dry it may be varnished, if desired. One gallon of the stain will cover 600 square feet of smooth surface.

Flemish Oak.—The wood is not filled, and the stain is black. Nigrosine black is used, and for quick work, such as picture frame makers use, the aniline spirit stain is required. Two coats may be given within one hour.

Or thin up some japan black with turpentine, and add a little coach varnish to bind it. Or, dissolve four ounces of Seal Brown aniline in one gallon of boiling water, and when cold add four ounces of strong vinegar. It will require several coats of this stain to make a black of some depth. Or Nigrosine black may be used in place of Seal Brown.

Light and Dark.—The light oak stain may be made with two pounds of raw Italian sienna and one-half pound of raw Turkey umber, both ground in oil;

thin up with one-half gallon each of boiled oil and turpentine, with one quart of brown japan.

Dark oak may be made from burnt umber alone, or with raw umber, or with umber and sienna, according to depth of color desired.

GOLDEN OAK.—One of the best golden oak stains is made from equal parts of gold size japan and best asphaltum varnish, thinning with turpentine. This stain will not raise the grain of the wood and it dries hard; wipe off soon after application. Asphaltum itself is the finest of golden or dark oak stains, but it acts rather badly under varnish.

A spirit stain may be made by steeping one ounce of powdered nutgalls in one pint of alcohol, which let stand, well corked, for three days. Then strain it. It should then be quite black. Now dissolve one-half ounce of Bismarck brown in one-half pint of alcohol, strain, and add to the first solution; then add a teaspoonful of tin chloride and enough alcohol to make the whole one quart. If the Bismarck brown makes the color too red use a solution of saffron in alcohol instead.

A water stain golden oak may be made with one pound of burnt umber and one-half pound of raw sienna, both in dry or powdered form. Mix with one gallon of water, and then add one gill of strong ammonia water, of about 28 deg. strength.

ANTWERP OAK.—Dissolve Nigrosine black in water and add a little Bismarck brown. The flakes of the oak should show up a coffee color or brown, and with the grain showing black.

GRAY OAK.—Silver-gray is a popular color in the Mission finishes, and here is a simple formula for making it. Dissolve four ounces of copperas and the same of powdered nutgalls; dissolve in one quart of hot water; then add enough cold water to make two

gallons of fluid or stain. This stain should not be mixed nor used in metal containers.

If the wood is poor grade add a little glycerine, to help keep the grain down. Then sandpaper, after which apply a thin coat of shellac, and fill with a filler made from white lead thinned a little with turpentine. Wipe off across the grain before the filler is dry, and get as much lead as possible in the pores of the wood.

The woodwork in the Elks' Home, Brooklyn, N. Y., was finished silver-gray in the following manner: The raw wood was stained with a thin solution of equal parts of raw linseed oil and turpentine, with a very little raw sienna and raw umber to stain the thinners. This was applied very thin and then wiped off. When this was dry the pores of the wood were filled with a gray white filler—or heavy lead paint. This was mixed to dry flattened when nearly dry, was rubbed off with excelsior or cotton waste. In this manner the pores, filled with the gray paint, gave a silvery appearance to the oak.

A very nice bluish-gray stain may be made from a solution of iron sulphate, the color depending on the strength of solution and tannin content of the wood.

Dark Oak Stains.—A very pleasing brown shade may be imparted to oak with strong coffee decoction. The alkalies darken oak; these are soda, potash, lime, ammonia, pearlash, etc. And these may be applied over washes of logwood, fustic, and madder.

Antique Oak.—Dissolve twelve ounces of powdered Vandyke brown in one gallon of water, to which add one pint of ammonia water, of 16 or 18 deg. Heat this stain on the stove, and after removing it, add one-half pint of turpentine, to prevent the raising of the grain.

Silver-Gray Effects.—Silver-gray is one of the most delicate and elusive of finishes. It is an acid stain,

hence most suitable to hardwoods, both open- and close-grained. Some object to the monotonous coloring of silver-gray, but where certain open-grained woods are used, such as oak, ash, chestnut, etc., this one-tone effect is broken up, because those woods exert a green or yellow influence which tends to the silver-gray off-color. Use a white paste filler with it, which will not only fill the pores of the wood, but will assist the stain to alter the influence of the natural wood color. But the paste filler is not advised for the close-grained hardwoods; however, the woods of this class are mostly maple and white birch, and are white enough to take the silver-gray very perfectly with the acid stain alone.

It is almost a rule that only the hard woods are suitable for silver-gray effects, but some very fine effects in this color have been obtained on gum wood. In this case both the white paste filler and stain are used, but the filler is applied on the acid stain without a coat of shellac between. The idea is to have the stain and filler meet. But be careful not to get the filler too thin, as you would do for an open-grained wood.

Gum does not ridge-up like yellow pine does when the acid stain is applied, at least not to any such noticeable extent; with yellow pine should be included the other soft woods. The effect is that of a silvery marbled gray, which is even more distinctive than the same effect seen on some of the woods usually employed in silver-gray staining.

Trouble in Oak Finishing.—In too many cases the oak furniture that comes to the finishing room consists of poorly matched parts, different kinds of the wood being put together without regard for the finished appearance. If the woodworker would exercise more care in constructing the piece, getting ad-

joining parts of the one kind of wood, the task of the finisher would be greatly lightened. There is no excuse for the putting together of a small and large figured piece. On this, as well as on some other accounts, there is more trouble in finishing oak than any other wood. Then the sanding of the wood should be done more carefully; taking a sample of oak with flake effects, it is better to use coarse sandpaper on it, which will tear up the grain, and if stained or filled then you will get a greater depth of color; after which, when dry, smooth it with fine paper. This will bring out the lights as clear as possible.

Oak Stain Formulas.—A rich golden oak color may be obtained by dissolving eight pounds of bichromate of potash and one ounce of concentrated lye in one and one-half gallons of boiling water. Let this stand over night, or from four to six hours, then add enough denatured alcohol to make four gallons of fluid. Then cut two ounces of logwood extract in one pint of alcohol and add it to the potash and lye solution. For a deeper color give two coats. Let the job stand over night, or even longer. Then sandpaper until the lights are clear, after which dust off and apply a walnut oil stain; wipe off with a clean cloth. The next day fill with a black paste filler.

Another shade can be secured by dissolving one part of permanganate of potash in thirty parts of water; stain twice with this in succession. After about five minutes wash over with clear water. Let it dry, then apply solution of iron acetate. Go lightly over the work with this, and it will bring out the dark shades and lines. Fill with black paste filler.

A good cheap oil stain may be made from one gallon of asphaltum, one gallon of benzine, and one quart each of benzol and turpentine. Fill before it is too dry on the lights, say in an hour.

Stains Various

Brown Stains.—Various browns may be obtained by mordanting with bichromate of potash and by applying a decoction of fustic or logwood.

Diluted sulphuric acid, applied to a clean surface, gives a brown stain varying with the strength of the solution. As soon as the acid has browned the wood sufficiently arrest its action by the application of ammonia water. Use a bristle brush for applying the acid.

A simple brown stain may be made by digesting in alcohol one-half ounce of alkanet root, one ounce of aloes, and one ounce of dragon's blood; one pint of alcohol. First mordant with an acid. Alcohol stains are usually not durable.

Tincture of iodine gives a fine brown on wood, but the color is not permanent, though it may be made largely so by coating it with varnish.

Bismarck brown one part, sulphate of soda eighteen parts, and Nigrosine one-fourth part; or you can omit the Nigrosine. Dissolve all in water to the required strength. Or try Benzo Brown three parts and table salt ten parts.

A good, cheap stain, useful for floors especially, may be obtained by dissolving one-fourth ounce of permanganate of potash in one quart of hot water, applying this hot and freely. At first the color is a bright magenta red, but it soon changes to brown. A darker color may be had by giving it two coats or more. When dry rub with wax or with boiled linseed oil.

Place one pound of powdered Vandyke brown in one gallon of hot water, and boil it until the quantity is reduced to two-thirds. Mix two ounces of potash with water enough to dissolve it, then mix it with the stain. Two or more coats as desired.

Sulphate of iron solution gives a yellowish-brown.

Boil one part of catechu, cutch or Gambier, with thirty parts of water, then add a little bicarbonate of soda. Apply the stain, and when dry apply one part bichromate of soda in thirty parts of water. By a little difference in the method of treatment, and by varying the strength of the solution, this will give various shades of brown. The stain is permanent and tends to preserve the wood.

Black Stains.—The following stain may be applied to almost any wood, and successfully. Boil one ounce of logwood extract in three and one-quarter pints of water, and when the dye has been entirely boiled out of the extract take the liquid and add to it one dram of yellow chromate of potash and then shake the mixture. The color at first will be a purple, but it quickly becomes black. This stain makes a fairly good writing ink.

Brazil wood one part, and five parts of water; boil with fifteen per cent. of alum. For a very deep black mordant the wood with iron solution, then apply the stain.

Nigrosine black four ounces, dissolved in one gallon of boiling water. A denser solution will give a deeper black, even a jet.

Apply a coat of hot logwood solution, let it dry, then give a second application; when this is dry apply iron solution, which will act upon the logwood stain and produce a dense black. It may be finished with wax and the wax be rubbed with raw linseed oil, or it may be left as it is.

Boil together powdered nutgalls and Brazil wood in soft water until the liquid becomes black; filter and apply hot. As many coats as may be required to produce a good black, following with a coat of iron acetate solution. If this is supplemented with a coat of alum

and nitric acid solution, with also a little verdigris, the durability of the stain will be increased. Finally, apply a decoction of nutgalls and logwood.

Break up one ounce of nutgalls and pour over it one-half pint of strong vinegar. After it has stood thirty minutes add an ounce of iron filings, which will cause the vinegar to effervesce. Cover it, but do not exclude all air. Let it stand another thirty minutes, and then it will be ready to use. Apply as many coats of this stain as may be necessary to get the depth of color you want. Keep in a tightly stoppered bottle.

Black Stains for New Furniture.—Of the various methods used for producing black stain on wood probably the best chemical substance to use is sulphide of soda or potash, in the lump. It makes a fast black, superior to that produced with acetate of iron or tannic acid. The first application of sulphide of potash or soda must be left to dry, about two days, before giving the second coat. An intense black results.

Boil one pound of logwood chips in two quarts of water for one hour. Apply it hot, and when dry repeat the application. Then dissolve one ounce of copperas in one quart of water, or stronger if you wish, and apply it. This will give an intense black, exposure to the air developing the color. For the finish make a size with dry lampblack and glue, with water, making the size very thin, and apply it. Sandpaper with fine paper, then apply a coat of shellac made slightly dark with drop black, thinning out with alcohol. Or add drop black to good copal varnish and of this apply two coats; the finish may be either dull or gloss.

Ebony Stains.—For hardwood apply two coats of Nigrosine black stain and fill with black filler; make smooth with fine sandpaper, then apply a coat of ivory japan black thinned with turpentine; when dry varnish and polish.

Take two pounds of logwood chips, one-half pound of copperas, four ounces of dry drop black, one pound of logwood extract, and boil in two quarts of water for four hours. Strain, then add an ounce of powdered nutgalls.

Nutgalls fourteen ounces, ground logwood three and one-half ounces, and verdigris one and three-fourths ounces. Apply one coat and let it dry; then apply two or three coats of acetate of iron solution.

Red Ebony.—Sycamore is a fine wood for making red ebony on, though beech is a close second. Mordant the wood with a hot alum solution, and when this is dry apply a hot solution of Brazil wood. When this has dried apply a cold solution of iron acetate.

Lignum Vitæ.—Sycamore and beech are the best woods for this stain. Apply a hot decoction of madder, let it dry, then apply a wash of sulphuric acid, washing off with clear water as soon as the desired depth of color is obtained.

The Best Woods for Ebonizing.—These are those woods that have a very close grain, and which are very dense and hard. Pear wood is considered by many to be the best wood, but apple, sycamore and hazelwood are very suitable.

Common Black Staining.—Boil together Brazilwood, powdered nutgalls and alum in soft water until the water turns black. Filter and then apply while warm. Repeat until the color is deep enough, then apply a solution of iron acetate.

Walnut Stains.—Mix together equal parts of raw umber and Vandyke brown to a paste with ammonia water; reduce to desired consistency with water.

Make up a mordant of permanganate of potash one ounce in one quart of water; apply it, and when dry apply a coat of a solution of one ounce of powdered nutgalls mixed with four ounces of potash and a little

Vandyke brown for color, so that there will be altogether one quart of stain.

Mix together one-half gallon of boiled linseed oil, one quart of best brown japan, and one-half gallon of turpentine; add two pounds of burnt umber, ground in oil. A deeper color may be had by adding one-half pound of either drop black or Vandyke brown. A lighter color may be obtained by adding one-half pound of burnt sienna to the first formula.

A light walnut stain may be made with one ounce of permanganate of potash dissolved in thirty ounces of pure soft water; apply two coats, allowing intervals of five minutes between coats. Wash off with clear water, and when dry oil and polish.

A dark walnut may be obtained by following the above formula and after washing with clear water make dark veins in the wood with acetate of iron solution, using a soft hair pencil.

A cheap walnut stain may be made by dissolving dry burnt umber in a little vinegar; then mix one pound of dry Venetian red with one pint of asphaltum and one quart of turpentine, adding this to the vinegar preparation.

White pine or any white wood will take a walnut stain well. Permanganate of potash gives a good walnut on white wood, and the natural growth seen in walnut may be imitated very nicely with soft hair pencil and acetate of iron solution. Privet berries, two ounces in one-half pint of water, yield a good walnut stain. Burnt umber is a good walnut color, and it may be lightened with burnt sienna or darkened with drop black or Vandyke brown. Vandyke alone gives a good dark walnut color. These pigments may be mixed with either oil or water.

To one gallon of shellac add one pound of dry burnt umber, one pound of dry burnt sienna, and one-quarter

pound of dry lampblack. Sift the pigments together, then stir in thin shellac. Apply one coat, let it dry, sandpaper lightly, and finish with shellac or copal varnish. Useful for the backboards of mirrors, etc.

Cherry Stain.—Bismarck brown makes a good cherry stain; place one ounce in two quarts of boiling hot water and add one-half gill of vinegar. Thin down with water if too dark.

A cheap stain may be made with one pound of dry burnt sienna and one pint of vinegar. Apply plenty and wipe off when done.

Mix two pounds of burnt sienna and one pound of raw sienna, both ground in oil, in two quarts of boiled oil, one quart of the best brown japan, and the same of turpentine.

Note Regarding Pigments.—In all cases where burnt or raw sienna or burnt or raw umber are mentioned it is to be understood that only the best grades of these pigments are to be used. The Italian siennas and Turkey umbers are the best. Even where the best sienna is used there may be a difference of shade or color tone, as siennas vary between dark and light, from a cherry-red to a brownish-red. In case you have the brownish-red for the above formula omit the raw sienna.

Dragon's blood gives a good cherry stain, two ounces to the quart of alcohol; shake it now and then, to hasten digestion.

Boil four ounces of annata in three quarts of soft water, preferably in a copper kettle; add a lump of potash about the size of a hulled walnut. Let the kettle be on the fire for thirty minutes after adding the potash; be sure the annata is perfectly digested before adding the potash.

Equal parts of alkanet root, aloes, and dragon's blood are to be steeped in alcohol that will equal in

weight twenty times the combined weight of the colors; use 95 per cent. alcohol. Let the decoction stand several days, in tightly stoppered bottles. Mordant surface of wood with dilute nitric acid, about ten per cent. strength; this will give a dark effect, but the stain may be lightened with alcohol. Strain it before using.

Red Stains.—Carmine thirty parts, ammonia fifty parts, salicylic acid three parts, and distilled water from 1,000 to 2,000 parts. Rub the carmine down in a porcelain mortar, and stir it up with a little water. The acid having dissolved in the ammonia, add the solution gradually to the carmine, which it will dissolve. Finally add the rest of the water by degrees.

Eosine aniline red one part, sulphate of soda ten parts, and acetic acid three parts, in water to give the desired strength.

Magenta No. 2, B, one and one-half parts, auramine one part, soda sulphate ten parts; in water to give the desired strength.

Azo cochineal two parts, soda sulphate ten parts, with water to give desired strength of color.

Rose benzol five parts, in water ten parts.

For the above aniline dyes use an alum-water mordant.

Blue Stains.—There are many ways of obtaining handsome blue effects with anilines. There are bleu de Lyon, with a reddish cast; bleu de lumiere, a pure blue; and light blue, which has a slightly greenish cast. These anilines may be dissolved at the rate of one part of color to thirty parts of 90 per cent. alcohol; apply stain to wood in the usual manner. Another very fine blue may be had by dissolving a little more than one ounce of the best indigo carmine in eight and three-quarters ounces of water. Give the wood several coats, allowing each coat sufficient time to dry. A very simple and cheap blue stain may be had by applying a coat

of Prussian blue, dissolved in water, repeating the operation for greater depth of color. When dry size with warm, not hot, glue size. When dry sandpaper lightly with fine paper; finish with a coat of varnish or polish.

GREEN STAINS.—Brilliant green three parts, Bismarck brown one-half part, and soda sulphate ten parts. Or Brilliant green one part, chrisoidine one and one-half parts, and soda sulphate ten parts. Or Malachite green one part, Nile blue, A, one-quarter part, and soda sulphate ten parts. All to be dissolved in water sufficient.

Emerald green may be obtained with a coat of Victoria green. A deep olive green may be obtained with a coat of yellow or orange stain on the Victoria green.

A handsome bluish-green may be obtained by treating the wood with prussiate of potash solution, after which apply a solution of iron acetate. This makes a sort of peacock blue.

The once popular malachite green stain used on furniture and house trim is made from Prussian blue and raw sienna, in certain proportions.

GREEN STAIN ON OAK.—Mix some bronze green paint in oil and make to a thin paint with turpentine. This is to be applied with a woolen cloth, not with a brush; rub it off well.

Or add four ounces of verdigris to three pints of strong vinegar; first pulverize the verdigris. Add one-half ounce of sap green and the same of indigo; add also some brown stain made from the hulls of walnuts boiled in water. Apply hot with a brush.

YELLOW STAINS.—Yellow stains vary greatly in composition, and most of them are rather fugitive. A fairly stable one consists of half as much barberry wood as water, by weight, adding a little alum to the extract.

Apply to surface of wood a hot concentrated solution of picric acid; let this dry, then stain it. Be careful with picric acid, very poisonous.

Boil one pound of Persian berries and two ounces of pearlash in one gallon of water; add gradually a strong solution of alum. When precipitated pour off the water.

For orange yellow apply a coat of nitric acid, one-half part mixed with one and one-half parts of rain or other soft water. The undiluted acid will give a brownish-yellow.

Yellows may be made from Auramine four parts, and sulphate of soda ten parts. Or Naphthol yellow one part and sulphate of soda ten parts. Or Crocein orange one part, sulphate of soda ten parts, and sulphuric acid one part. Water sufficient.

Rosewood Stain.—To one gallon of alcohol add two ounces of camwood; set it in a warm place for twenty-four hours, then add three ounces of logwood and one ounce of nitric acid; when all is dissolved strain and use.

Apply a coat of aniline blue, over which apply a coat of crimson, orange, or yellow stain.

To one pound of rose pink add one pint of good asphaltum varnish, one pint of the best brown japan, one pint of boiled oil, and one quart of turpentine. If the color is too dark add more rose pink; if too light add more asphaltum and turpentine.

Dissolve two ounces of Eosine, G, aniline, and one ounce of Nigrosine in two quarts of boiling water; when cold add one-half pint of vinegar.

STAINING WICKERWARE AND WILLOW FURNITURE

THE wood must first of all be mordanted with lime water, this being prepared by slaking fresh quicklime with water enough to cause it to fall to pieces and into a powder; to one pint of this fine powder add from fifteen to twenty pints of water; allow the lime to settle from the water, after having stirred water and lime well together, and then pour off the clear liquid for use.

The willowware manufacturer steeps the willows for several hours in the lime water, then they are dried with heat running up to 100 deg. After drying, and before becoming cold, they are steeped in a fluid stain; brown is most commonly used, though many other colors also come into use.

BROWN STAIN.—Dissolve one ounce of permanganate of potash in five parts of water; dip the willows in this and lift them out at once, allowing them to drain off. This gives a pale brown, but various dark tones may be obtained by allowing the willows longer time in the potash solution.

Or dissolve four and one-half ounces of potash in five pints of water, and steep the willows or wickerware in the fluid for two hours, then boil for two hours in a boiling solution of pyrogallic acid, made by dissolving two and one-half ounces of this acid in five pints of water.

Or dissolve three and one-half ounces of catechu and one and one-half ounces of soda crystals in five pints of water by boiling; steep the wickerware in the

fluid for three or four hours, let it dry, then steep for one hour in a solution of five ounces of bichromate of potash in five pints of water.

BLUE.—Dissolve two ounces of indigo carmine in one quart of water, and soak the wickerware in the fluid for five or six hours.

GREEN.—Dissolve two ounces of indigo sulphate and one ounce of picric acid in fifty ounces of boiling water. Steep the ware in the fluid for several hours. Different tones of green may be obtained by altering the relative proportions of the coloring matters.

YELLOW.—Dissolve one ounce of picric acid in five quarts of boiling water and steep the ware in it for two hours.

All the foregoing bright colors are to be obtained only on fresh, clean stock, the wood being white. But old wickerware can be stained as described further on.

GRAY.—In the case of new wickerware it will be found that by coloring it a gray the dirt and grime will not show so readily as with the unstained wood. A good gray may be obtained by dissolving forty-five ounces of iron sulphate in seven and one-half pints of cold water; steep the ware in this for from two to six hours, and then, after drying, steep in a solution of one and one-half pounds of pyrogallic acid in five pints of water.

STAINING OLD WICKERWARE.—Dissolve one and one-half pounds of aniline nitrate and one ounce of copper chloride in nine and one-half gallons of water. Boil the ware in the fluid for one hour, then place it in a boiling-hot solution of bichromate of potash for one-half hour, using eight and one-half ounces of bichromate to the gallon of water. Or this: Boil twenty-five ounces of logwood extract in twelve and one-half pints of water containing one-fifth ounce of alum. Filter or strain the fluid, and steep the wicker in it

for from two to six hours. Keep the liquid at the boiling point all the time, then remove the ware from the fluid and let it dry. Then steep it in a boiling-hot solution of iron sulphate fifteen ounces in seven and one-half pints of water for from two to four hours. This gives a more or less bluish-black with a gray cast, but by steeping it in a decoction of thirteen ounces of copper sulphate in one and one-fourth gallons of water a deeper black will result.

The Aniline Colors or Dyes.—The aniline dyes are much more effective than the foregoing mineral and chemical colors, as the anilines need no steeping, they dyeing the wood at once. In fact, aniline stains may be applied with a brush or sponge. For very bright coloring the anilines must be chosen. The wood should be mordanted with a solution of six ounces of Castile or good white soap in twelve and one-half pints of water, soaking the wood in this, and then drying it before applying the coloring. Anilines soluble in water are to be used, the water warm, say from 86 deg. up to 140 deg. Stir the liquid well, then steep the ware in it until you get the depth of color desired. As the dye liquor becomes weak it must be strengthened with freshly made dye solution. A very small amount of aniline will do.

Blue. Dark Blue.—Dissolve three ounces of Bengal blue in three and one-half pints of boiling water, and stir and filter the fluid in ten minutes' time.

Light Blue.—Dissolve three ounces of bleu de lumiere in one-half gallon of boiling water.

Sky Blue.—Dissolve three ounces of bleu de ceil in one-half gallon of water.

Greenish Blue.—Dissolve three ounces of bleu de vert in one-half gallon of boiling water.

Various. Dark Green.—Dissolve three ounces of

methyl green and one-half ounce of bleu de lumiere in one-half gallon of hot water. Light green. Dissolve one ounce of methyl green in a pint of boiling water.

RED.—Dissolve three ounces of coral red in five pints of water. Dark red, dissolve three ounces of fuchsine and one ounce of orange in three pints of water. Rose red: Dissolve three ounces of rose Bengal in five pints of water.

VIOLET.—Dissolve three ounces of methyl violet in one-half gallon of water.

REDDISH VIOLET.—Dissolve three ounces of methyl violet and one ounce of fuchsine in one-half gallon of water.

GOLDEN YELLOW.—Dissolve three ounces of naphthaline yellow in one-half gallon of water.

BROWN.—Dissolve three ounces of Bismarck brown in one-half gallon of water. Chestnut Brown: Dissolve one ounce of maroon in one pint of water.

The list given includes only a few of the many colors that may be used in wood staining, but those given afford some idea of what is possible along this line. The quantities of dye given in the formulas produce a very concentrated stain, and if more is used the result will be a bronzing of the colors. The formulas are for strong solutions, and they may be reduced if too strong, using water. As the stains are used for successive dippings they become weaker, and must be strengthened from time to time with fresh dye.

The dyed wickerware is finished with a coat of lacquer, made and used as follows: First dip the article in a thin size of glue or gelatin, which must be kept hot. This closes the pores of the ware and gives a good foundation for the lacquer. For white goods use white shellac, and for dark goods use a mixture of white and orange shellac. Some use copal

varnish instead, but lacquer is better, as it is more flexible and less inclined to crack. For black work dark or orange shellac is used.

STAINING WILLOWWARE FURNITURE.—The stain will take more uniformly if the goods are mordanted with this preparation: Take nine ounces of chloride of lime and one ounce of soda crystals in five pints of water. Several coats of this mordant are required, and each coat must be dry before another is applied. Then apply a weak solution of sulphuric acid, and rinse at once with clear water. Let dry. Use alcohol aniline stain, as it penetrates better than either water or oil stain. But if water stain is used apply it hot.

Experience is necessary to stain wickerware successfully; hence if not successful at first, do not be discouraged, but try again.

THE EQUIVALENTS OF WATER COLORS IN ANILINE DYES

Water Colors	Aniline Colors
Sap Green	Naphthol Green
Emerald Green	Emerald and Malachite Green
Scarlet	Eosin and Biebrich Scarlet
Violet	Methyl Violet and Gallein
Burnt Sienna	Bismarck Brown
Ultramarine	Cotton Blue, Alkali Blue
Sky Blue	Methylene Blue
Lemon Yellow	Picric Acid
Golden Yellow	Naphthol Yellow
Magenta	Magenta
Cadmium Orange	Phosphine, Aurantia
Crimson Lake	Congo Red

DESCRIPTION OF STAINS AND THEIR USES

THERE are three classes of stains used by the wood finisher, namely, Oil Soluble stains, commonly known as penetrating stains; Pigment Oil stains, or pigments ground in oil; and Acid stains, more generally known as water stains, but erroneously, as will be explained further on.

OIL SOLUBLE STAIN.—The average stain of this class is made from an oil-soluble aniline dye, the thinning fluids being turpentine, benzol, acetone, with japan driers. The factory-made stain is effected under heat. The peculiar feature of this stain consists in its power of deeply penetrating wood, without leaving pigment on the surface. The staining is effected without clouding the grain of the wood, a most desirable accomplishment. The purpose of staining natural wood is to develop and enhance its beauty of figure and grain, where this is possible. But it is not always possible, as the result will depend upon the character of the wood itself. All woods will not take the same stains equally satisfactorily. Some woods have a close grain and small figure, while others are soft and porous and have a large grain. If the figure is small the grain should be brought out. But if the grain or figure is quite outstanding we then must subdue it and get a more uniform effect. This can readily be done by the use of the proper stain and its application.

The oil soluble stains come ready for use in the various favored colors or tones, being particularly adapted for staining Mission effects on oak, mahogany effects on birch, and walnut and mahogany effects on gum;

they are also used on some of the softer woods, such as pine and cypress, where the grain is not too prominent.

Great advance has been made within the past few years in the production of wood stains by American manufacturers. As late as 1915 the American dyes were far below the quality of the German brands, but since that period the case seems to have been reversed, as our aniline dye manufacturers claim their wares to be superior to the German goods. They claim for American-made dye stains that they are smoother working, they dissolve better, they leave no sediment, and they are more suitable for their purpose as stains. As to durability or resistance to light, while superior to the dyes we used to have, it must be admitted that they remain to some, though less, extent unstable. The representative of the largest manufacturing concern in the country, speaking on the subject of mahogany penetrating stain, admits that there is not a mahogany penetrating stain on the market to-day (1921) that is absolutely fast to light, that will not fade. They will do very well under certain favorable conditions, but subject a piece of wood, stained with oil soluble aniline stain, in a window, say, exposed to the sunlight an hour or more each day, the stain is sure to fade.

There exists in some of the oil soluble stains, notably in the mahogany, what is generally known as the act of bleeding. In this they demonstrate their penetrating qualities better than in the matter of wood staining. It is usual to apply a coat of shellac after the staining, and as part of the stain is soluble in alcohol, and as shellac is thinned with that fluid, the result is that the stain is dissolved by the spirit and eats its way through the shellac to the surface, discoloring whatever finish may be on the wood. Painters and paper hangers have this difficulty to contend with, the former by reason

of having to paint (enamel usually) over mahogany-stained woodwork, and the latter having to hang paper over other paper that has been printed with aniline dye. Expert painters declare that aniline mahogany stain will come up through as many as a dozen coats of paint, and do it after ten or more years from the application of the paint. This will show how penetrating and powerful it is. To meet the difficulty it is only necessary to coat it over with aluminum bronze. In one case the stain had not worked through in two and one-half years. Shellac will not keep the stain back. Iron pipes coated with gas tar offer a like proposition; no amount of shellacking will keep back the tar stain.

In order to make the mahogany or other oil soluble penetrating stain as fast to light as possible it should be coated with thin shellac varnish (more properly lacquer). This glaze coat should be tinted, as this gives a better finish than an untinted coating. And shellac is better than oil varnish over the stain, and indeed oil varnish should not in any case be applied over this stain, direct.

It should be stated here that oil penetrating stain does not raise the grain of the wood, hence is more economical than water stains.

Oil Stains.—In former years these stains were the only ones used, being followed by water stains, where the same pigments were used, as were also vegetable dyes and colors. And oil stains have a wide use to-day, being suited to some woods better than water or oil soluble stains. These stains are prepared from pigments that have been ground in raw linseed oil, and which are prepared for use in staining by thinning out with turpentine, or oil, or benzine, with some drying agent, japan usually. Or oil and turpentine or benzine may be used in combination, with japan dryer. The chief trouble with oil stain is that it is not fine enough,

it will leave some pigment on the surface of the wood, and which to some extent obscures the grain of the wood. Oil stains are especially adapted for use on the close-grained woods, such as white pine, poplar, whitewood, maple and cherry. As these stains are not as penetrating as the anilines, they fail to bring out the figure of the wood satisfactorily.

When cherry and maple were the favored woods oil stains were generally used, but since the advent of such favored woods as birch, gum, pine and cypress, which take all sorts of color tones, their use has greatly fallen off. Yet they have great merits in certain forms of wood finishing, some account of which may be found in this work under the proper heading.

Acid Stains.—Some confusion exists in the minds of many finishers regarding the term acid. It may be explained that the acid stain is the modern water stain, but that it is entirely distinct from the old water stain. The latter was simply an aniline stain dissolved in water and thus applied. The modern water stain is a water stain of course, but the chemists have added some chemicals that result in a stain that will give effects not possible with the old water stains. It is only within the past two or three years that these improved stains have come into use, and were necessary to the doing of the type of staining now in use. People became tired of golden oak, red mahogany, etc. Such woods as gum, cypress and the like are in demand, together with the old-time woods, hard and soft. Necessity, from the near exhaustion of the old-time favorite woods, compels us to like such finishes as cypress and gum. Still, this class of woods has undeniable merit.

To understand the adaptability of these modern woods to stains, woods such as cypress, redwood, yellow pine, etc., procure a set of slats from some stain

manufacturer, or the photo-colored illustrations thereof. They will show how well such woods can be treated with stains, even with the very lightest of color, even with white, producing the gray effects. To the stain manufacturer the wood-finisher owes much in the fund of practical information given, the results of tedious and costly tests.

In order to obtain a uniform color effect on certain woods it is necessary first to apply a thin size, usually of shellac, though a thin coating of a surfacer will do very well. One stain making firm call this coat the "evener." It simply prevents the stain from entering the wood, staining the "evener" instead. We have mentioned this method in another place. It is always used where it is desired to prevent penetration, and is often used on parts of a wood where the stain would produce an effect different from the rest of the surface. This evener is lightly sandpapered, then the stain is applied. It is possible to give the coat of evener and stain in the one day. That saves time and works for economy. The coating beneath the stain will do even better if a little of the stain is added to it.

Furniture makers use that method, in the finishing room, to remedy unequal condition of wood; that is to say, where there are hard and soft spots.

To test stain for clearness apply some of it to a piece of glass and hold the glass against the light, which will reveal any opacity; stain should be perfectly clear. Another way is to stain the glass and place under it a piece of printed paper; the clearness of the stain will be according to how easy or difficult it is to read the print; dark stain would of course hide the print too much to enable you to read it, at least easily.

There will be no bleeding with alizarine red, which is the substitute for madder root. There are also non-bleeding crimson and maroon lakes. But the ordinary

oil-soluble stains will be apt to bleed. Its fatty nature is the cause of its oozing through the shellac or varnish coats. Pigment oil stain is safer, but does not give the lively effect that aniline stain does. It is more like a paint. Yet the anilines are not always satisfactory, and in many cases it is best to use the oil stains.

The oil soluble aniline stains are, with a few exceptions, light-proof when protected by varnish, as most of them are composed of alizarine, the most light-proof coal tar derivative known. It can be had in various types of black, brown, blue, green, orange, red, and yellow, all but the blue fairly permanent when used as an oil stain.

There is on the market a celluloid lacquer that acts differently from shellac lacquer or oil varnish, in that, so it is claimed, the aniline dye will not come through it. If this is the finish over the stained work the color holds, it does not bleed through. That is the claim.

Aniline water stains are made from water soluble anilines. Ask for these when wanting to make water stain. The formula for any of these water soluble stains is one-quarter pound of aniline to three gallons of hot water. The water should be boiling-hot, and the stain should not be used until cool; the addition of three half-pints of vinegar will improve the durability of the stain.

To give to curly maple the golden brown or deep yellow effect, to look like the wood when mellowed by age, dissolve one-half pound of orange shellac, two ounces of pearlash and one ounce of gamboge in one-half gallon of denatured or wood alcohol. If you desire it deeper or more reddish, use in place of gamboge either all or part dragon's blood. This stain has one advantage over the alizarine stain, it will not raise the fiber of the wood and the shellac will aid to make it fairly permanent, improving in color with age.

To do uniform staining one should have a uniform light, as the appearance of stain changes with a changing light, showing a deeper color tone as the light fades and growing paler as the light becomes brighter. The north side of a room is better for staining, as the light here is more uniform, for one is not bothered by the direct rays of the sun nor the shadows of passing clouds.

Soluble Vandyke brown will furnish a very good walnut stain, but it is far more simple to purchase alizarine brown, extra deep, and dissolve it like Bismarck brown in hot water.

The first essential to successful staining is a clear, transparent stain. For oak, oil or acid stains are preferable, water stains being but seldom used. On walnut, oil stains may be used with fairly satisfactory results, although water stains make a nicer job. But when it comes to the staining of mahogany there is only one stain that can be recommended, and that is a water stain.

The proper application of stain, such as water, acid and spirit stain, is a matter of experience and efficiency.

It must be done quickly, and one must avoid going over part of the surface a second time and must not use any touching-up methods. All parts of the wood must be covered with one stroke of the brush, if possible, and a good full bristle brush must be used.

The idea that all stains are made from coal tar is not true. It is true, however, that many stains are made from coal tar products. For instance, those made from benzol, naphthol, phenol and alizarine. Still others are made from salicylic acid, resorcine, tannin, etc. These substances are all chemicals and are treated with other chemicals to get the desired color. I state this for the reason that manufacturers receive complaints that stains come through, and the customers think it

due to the action of the coal tar in the stain, when, as a matter of fact, no coal tar has been used.

Very often the fault lies with the man who does the finishing. Oversaturation is harmful in staining woodwork. A piece of wood will absorb just so much liquid stain and no more. Woodwork that has too much stain, will always hurt the varnish. To do satisfactory work all stained woodwork must be wiped, when nearly dry, so that if there is too much stain on the surface, the surplus will be removed.

Oak is the wood most frequently stained with an oil stain, and, being very porous, it sometimes happens that the stain penetrates to a considerable depth and does not dry out thoroughly before the filler is applied (if the wood is filled), and in time it begins to ooze out, sometimes long after the varnish has been applied. A turpentine stain will rarely do this, but a stain whose body is asphaltum varnish or oil has not the penetrating qualities of a turpentine stain, and, therefore, finds lodgment in the larger pores and does not dry. This difficulty is frequently experienced with end wood. To avoid the trouble above mentioned it would be well to apply the stain with a cloth, as in this way it can be spread out more quickly and uniformly than with a brush, and by so doing the stain will be prevented from penetrating to an unnecessary depth.

If one has trouble with the stain cleaning off too much or fading under the process of filling, the trouble may be avoided by applying to wood a coat of very thin shellac. Put this on after the stain is dry, and allow it about half an hour to dry before filling. This thin coat will also make a wonderful improvement in the surface for finishing if sandpapered lightly with fine paper, after the filler has become dry and before any additional coats are applied.

It is not always practicable to stain moldings with a

cloth. The same may be said about getting into corners. For this purpose use a fine brush, such as bear or camel-hair, as a bristle brush is too coarse and loose and releases the stain too rapidly.

CUBAN MAHOGANY.—One frequently has some Cuban mahogany to stain and match African mahogany, and sometimes crotch. Cuban mahogany, being much harder and stronger than most other varieties, is used extensively in making chairs which call for genuine mahogany, and which must be stained to match the other pieces of the suite to which they belong. If the chairs were to match a crotch dining-room suite it would not be expected that the chair frames match the figure of the crotch, but it is expected that the color tone be in harmony, and the whole stained sufficiently dark to prevent a contrast. The dark figure in the crotch makes it necessary to bring the color of the chairs to about midway between the light and the dark parts to produce the desired degree of harmony.

It is much easier to stain Cuban mahogany to match African stripe mahogany than it is to make it match crotch, for all that is required is to use the stain about 50 per cent. stronger. Cuban mahogany can also be made to match African mahogany in figure without any great difficulty. To do this, first prepare a stain double the strength of that used on the African mahogany. Next, stain the Cuban mahogany with the same stain as used on the African mahogany, and, while this stain is yet wet, put stripes on it with the dark stain, using a small camel-hair pencil brush for the purpose. If the dark stain is applied before the first stain gets too dry it will flow out beautifully, and nothing less than a very close examination by the most expert can detect that they are not natural, and by following the grain closely I have deceived experts. Of course, one does not want

very much of this striping on a chair frame, but just enough to relieve the striking plainness.

The same thing may be done with gum and birch that is used along with figured mahogany. It sometimes happens that a block of solid mahogany without figure will find its way into a piece of furniture, and this, too, can be touched up and made to match.

The finisher should make it his business to watch closely the joints of all crotch mahogany, Circassian walnut and other butt-joint work, to see if all the markings match. It may be that in cleaning up the veneer some of the markings running close to the surface are removed, or the matcher had not got all the figures in correct alignment, and if these things are not remedied they will present a very bad appearance after the finish is applied. By the use of stain and a pencil brush these figures can be drawn out and enlarged or new figures added to replace those lost in the cleaning, until the whole is perfectly matched. Or if one wishes to increase the depth of color of some of the marks it may be done in this way. The kind of stain to be used depends on the color of the veneer to be touched up and the color of the stripes to be enlarged. Mahogany can usually be touched up with a mahogany stain, soluble in either water or spirits, while Circassian walnut and other walnut butt-joint work may require walnut crystals and nigrosine. Oil colors may also be used at times, but where colors soluble in water or alcohol will answer they are usually preferable.

French Polishing.—This old and little employed form of wood polishing consists in the repeated rubbing into the wood of shellac, using a rubber or pad that has been slightly coated with boiled linseed oil, which makes the rubbing easier. Wood that is not perfectly straight-grained, clear and solid, should first be sized with thin glue size, and then when the size is dry lightly smooth it with fine sandpaper. A modern method indicates a filler made with plaster of Paris and water, colored to suit, removing all surplus filler, which will render sandpapering a simpler task. Other fillers may be used, but most prefer the plaster filler. But the original method of polishing did not call for a wood filler, the shellac being rubbed into the grain of the wood until a surface was made. This surface was then made smooth with a soft polish. Orange shellac is used for this purpose. As shellac is affected by both cold and dampness it is best to have a temperature of about 72 deg. where the work is being done. At least the temperature should not be very much lower than this.

The rubber used can be made from a strip of woolen cloth, one inch in width, and which is to be rolled up like tape. Over this draw a piece of clean, soft muslin, the edges drawn up on one side of the rubber and tied there, forming a handle. This rubber is intended for rubbing flat surfaces. For irregular surfaces make a rubber from raw cotton wool, tied in a piece of muslin, with a handle on one side, like the flat rubber. The

rubbers must be perfectly smooth on the rubbing side, having neither crease nor wrinkle.

Having your rubbers ready, and being ready to begin work, remove the outer wrapping of the rubber and apply a few drops of shellac on its face; be careful not to get too much on, but just enough so that when the pad is lightly pressed a little of the shellac will exude. Too much shellac will cause a rough surface, spoiling the work. The process demands care and skill.

Having applied a few drops of shellac to the inner rubber replace the outer covering, tie it, to form the little handle, and then apply a few drops of raw linseed oil to its face. Begin at a certain part of the work, rub evenly and with light pressure, working in a circular manner until, gradually, you come to the opposite part of the work; now and then apply a drop of oil to the rubber. Once you start rubbing keep the rubber in motion until you reach the opposite part of the work, otherwise you will leave a ridge or other form of unevenness, to remove which will involve considerable time and labor. This is very important. Don't let the rubber become dry as you proceed, but watch it and whenever it gets a little like drying place a drop or two of oil on it, with a little shellac on the inner rag.

After rubbing in several coats, and a soft luster appears, a dry rubber can do no harm. In fact, at that point a dry rubber is desirable.

Every time that you apply shellac to the pad squeeze a little of it out on to the palm of the hand, working the pad a little in it, this equalizing the shellac in the pad. Should the muslin covering the pad become shiny shift it and use a fresh part.

Should you be unfortunate enough to have rubber marks appear on the surface of your work remove them by rubbing with the wet rubber, but beginning at the point that you left off at and working in the opposite

direction. In all cases it is advisable to employ long strokes with the rubber, rather than short, jerky strokes. Some finishers rub lengthwise of the work, then in a circular direction. Do not press too hard on the rubber, nor rub too long in one place. Place the shellac in a saucer, for convenience when rubbing, though a bottle is better. Rub out dry marks with a half-dry rubber, bearing on with a little more pressure than when first rubbing.

If you have a large surface to polish, like a table top, polish but one-half of it at a time. Leaves or boards of tables may be done one at a time.

After rubbing the broad surface with the circular motion, go over it again, rubbing with the grain of the wood. Rub a few times only, the purpose being simply to remove the rubber marks of the first rubbing. In the beginning rub with very light pressure, increasing the pressure as the rubber becomes drier. When the polish looks rough or scratched smooth it gently with fine sandpaper, and be sure that the polish is quite hard before you do this. Do not try to remove this roughness by hard rubbing nor by excess of rubbing in one place. The latter operation will result in the softening the whole body of the polish, causing it either to rub up or rub into ridges. If there is too much shellac on the rubber the alcohol in it will mar the polish. If the room is too cold or damp you will likely get a milky surface, to remedy which take the work near a fire, and the heat will gradually restore the polish.

Give the work but one coat of polish a day, but rub in coats enough to form a film of shellac on the surface of the work, proving that the pores of the wood have been filled. If then the job presents a perfectly uniform surface it may be "spirited off," which is done with the rubber and some alcohol. Dampen the rub-

ber with alcohol and pass it lightly and deftly over the surface of the polished work, using the alcohol sparingly. The alcohol removes the oil left on the polish, leaving the polish bright and handsome. If this were not done then the oil would remain to dim the polish. But as it is very easy to do injury to the polish with the alcohol, care must be exercised in its use. Some finishers use alcohol from the start, gradually reducing the amount until the last coat is mainly clear alcohol.

For spiriting-off use a new pad or rubber, three or four folds of muslin over a wad of raw cotton; some prefer cheese-cloth to raw cotton. These coverings may be removed one by one, as they become dry, the inner pad holding the alcohol. Rub in a circular way.

It is thought by some workmen that it helps the alcohol to stand exposed to the air for an hour or two. The only effect such exposure could have would be to weaken it by its absorbing moisture from the air, alcohol being a greedy partaker of water; hence the addition of a little water should be equally as good as the exposure. The purpose of a weaker alcohol is to guard the workman from injuring the polish.

To save the time, trouble and risk involved in the spiriting off process some polishers give a glaze to the finish, which forces a gloss or polish, making the removal of the oil unnecessary. The glaze is made from gum benzoin dissolved in alcohol. Take one-half pint of strong alcohol and dissolve in it two drams each of gum shellac and gum benzoin. Place in a bottle and shake occasionally. Stopper tight. When the gums have dissolved add two teaspoonfuls of white poppy-seed oil, shake well, and the mixture is ready. As previously stated, this is a glaze, and is so applied.

For very light colored woods use white shellac, which may then be colored to suit any color of wood in

hand; but orange shellac is commonly used in French polishing.

A cheap method of French polishing black work may be done by the following formula: Beat to a paste some Japan drop black, then add to it, at the rate of a tablespoonful to the half-pint of black, rubbing varnish; mix thoroughly, then thin out with turpentine or benzine. Apply several coats of this black, drying each coat, and lightly sandpapering to a smooth surface. When all is done and dry apply a coat of good furniture varnish, which rub to a polish with pulverized rottenstone and sweet oil.

Since the appearance of the second edition of this work I have been given another method of cheap or easy French polishing, the donor, residing in Canada, stating that he has used it for many years, that it will do the work in a saving of seven-eighths time, that the work will be as good as the real French polishing, and that it will stand out better than any polish that has ever been placed on the market. Which is claiming much. He says:

"Fill and stain your woodwork, put on one coat of shellac and two coats of good rubbing varnish; sandpaper in between coats, and rub the last coat to a dead finish with pumicestone and water. Now you are ready for the polish. Take one ounce of muriatic acid, one ounce of turpentine, one pint of raw oil, mix together. Take about one-eighth of a pound of waste; fill it with the above polish so that your waste is moist. Now take a piece of cheese-cloth dipped in water. Put it around the waste so it forms a ball. Put a little rottenstone on it and go to it. You will find that it will polish instantly. The more you rub, the higher the polish. After you have your woodwork or doors polished, take a piece of cheese-cloth, dampen it with grain alcohol, and rub the oil off."

Oil Polishing.—Oil polish is especially useful on wooden surfaces that are to be subjected to more than ordinary hard usage, or exposure to the weather. It is a very ancient method of wood finishing, antedating French polishing by many years, and is even older than varnishing. The proper method requires that the bare wood be saturated and filled full with linseed oil, the surface being then rubbed as will be described further on. Water has no effect, generally speaking, on such a filled surface, and while certain liquids and hot dishes will mar the surface, these blemishes are easily remedied. Such is not the case with shellacked or varnished surfaces. Hence the desirability of oil-finished surfaces for bar tops, tables, and so on.

Any kind of wood when oil finished will darken with age, whether filled with special filler, or simply oil-filled, though the former will not darken so soon as the other. This is well to know, because you may at some time have to oil-finish a part to match an old part, and allowance will have to be made for this darkening of the new finish.

Not all kinds of wood are oil-polished, the soft woods being ill-adapted for this form of finish. Such woods as beech, chestnut, mahogany and oak, and other like woods, lend themselves to this form of treatment.

It is not advised to fill the wood, and it is only done when it is desired to save time and labor. Oil polish does not look as well on a filled wood as on that which has been treated with oil only. All mineral-based and animal oils must be discarded, and only vegetable oils be used. Linseed oil is the best and most generally used. Raw linseed oil is not used. The oil should be kettle-boiled, manganese boiled oil being the best of this class. Raw oil does not furnish sufficient body, and it also dries soft and tacky, remaining so for some time, and it tends to soften up under the repeated

applications necessary in this form of finish. Obviously, no sound, durable finish could possibly be obtained with raw oil.

To effect a perfect job of oil polishing the wood must be perfectly smooth. Saturate the wood with the oil, and rub down with brick or lump pumicestone, preferably, though fine sandpaper or steel wool will do. This will give you a perfectly smooth surface, and all surplus oil must be wiped off before the polish sets or dries.

The polishing is then done. This consists in applying the oil and rubbing it into the wood with a piece of felt. Apply one coat only, and let this stand several days, so that the undercoating may have time to dry, and so that the succeeding coat may adhere securely to the surface coat. After each application and rubbing wipe off the surplus oil with a clean rag, soft woolen the best. The more time you allow for each coat to dry before applying the next the better the finish will be.

When you have secured a proper surface with these repeated applications, rub it with the following preparation: One quart of kettle-boiled linseed oil, one or two gills of alcohol, one to two gills of turpentine, and one quart of strong vinegar; it will improve this composition by adding a teaspoonful of butter of antimony. Shake this all together until perfect amalgamation occurs. Rub the oil-finished surface briskly with a soft woolen rag, wet in the liquid.

The high polish obtained by this method will not crack, peel, scale or check, and it is not affected by water or ordinary usage. It is the most durable form of wood finish. I am speaking now of the formula just given; it does also on a varnished finish, improving its appearance. It will be found satisfactory, too, on the finest piano.

Polish-on-Varnish Finish.—This is the German acid method of polish finish, and it consists in bodying up the work with copal varnish, instead of shellac. This process, which will now be described in detail, was called the "vitriol finish."

There is a very evident difference of appearance in the cabinet and furniture work turned out by foreign manufacturers, not only so as regards design and construction, but the finish also. Perhaps this is due to climatic conditions or influences, partly so at least. From this cause alone a finish that gives excellent wearing results in one part of the world may fail utterly in another.

The finish on English cabinet and furniture goods and that on the French are very nearly alike, because England, more than any other country perhaps, adopted the French style of finish. For a long time the German manufacturers also used the same method, with this difference: That on high-class goods that would stand the cost of labor, they used powdered pumicestone liberally in the early stages of the work, thereby obtaining a perfectly level finish, much thinner in body than that seen on English-made goods. And as they had the advantage of using a much purer spirit for dissolving the gums one might reasonably suppose that their work would be vastly superior as regards wearing qualities, as well as excellence of workmanship. That this was not so is due not so much to the method of its application, for no doubt these three countries adopted practically the same method and approximately the same class of materials.

Unfortunately, in the distribution of the polish solution—as made from shellac and, in some cases, a small percentage of other gums, dissolved in alcohol—it is necessary to use a small quantity of oil, to aid in its even distribution and easy working, and it is this use

of oil before applying the polish, and with it, that causes trouble. There is always a tendency on the part of workmen to use oil too freely.

Some gums work more sticky than others, and while one brand of spirit may work very mild, and not require much oil to assist in the work, another brand may work up hot or dry too quickly to permit the work to clear out bright without using an excess of oil. Recognizing this, some workmen use poppy oil instead of linseed oil, and with a decided advantage. But no matter what kind of oil may be used, it often happens that there is enough left behind, either lying underneath the polish or incorporated with it, that in time works out to the surface, causing sweating of the finish. Usually in working its way out it breaks up the film of shellac into a cobwebby form and presents a cracked appearance, which, if not cleared away at once, becomes hard, in the form of minute ridges, to which dust clings and dusters drag when cleaning off the surface is attempted.

While the oil is thus oozing out the same atmospheric influences that caused it often cause another trouble. It only requires a slight heat that is prolonged for a few days to soften up the shellac used as a polish. As it softens up again it sinks into the wood, on some woods to the extent of forcing the grain-filler out, thereby giving the work an unfinished appearance, as if the work had not been completed, or had not been skillfully done. This is especially noticeable in goods faced with thin veneer.

Even by the use of a superior grade of alcohol the German finishers were not free from these difficulties, but they were the first to seek out some means whereby the action of the oil might be prevented. This was to a great extent accomplished by what was called the

vitriol finish. This, in its way, was a grand achievement, but it only did half what was required; it made no provision for the sinking-in and loss of gloss caused by a heat wave, or the overheating of rooms by gas or fires, nor did it prevent the perishing of shellac polish likely to be caused by excessive dampness. Recognizing this, the Germans went one step farther, and on high-class goods abandoned the shellac finish in favor of one brought up by successive coatings of copal varnish, each coat allowed to become perfectly hard, so that it could be ground down to a dead level with felt pads, powdered pumicestone and water. When this had been done some four or five times French polishing, in the strict sense of the term, began, the dull surface being worked upon with a polish made from bleached shellac, using a trifle more oil than in the usual practice when the whole of the work is being done with French polish. Thus we have what is sometimes called a "polish on varnish."

There is, however, this difference: The application of polish is not carried out to its fullest extent; that is, the final luster is not brought up by means of spirits only. The polishing is proceeded with to a stage when it is just ready for clearing out the oil and bringing up the luster with spirits. Instead of using this, the work is pounced rather liberally with precipitated chalk. Then, having a suitable vessel at hand and containing diluted sulphuric acid, one part to ten of water, the workman dips the palm of his perfectly clean hand into the acid water and with it proceeds to rub the chalk with a circular movement, applying enough acid water to form the chalk into a creamy paste, then continues with the rubbing, using his fingertips to get into the corners and moldings, until the chalk dries to a fine powder again. The effect of this is that the final luster is brought up by what may be

termed "hand polishing"; the acid has the effect of hardening the polish film of shellac, while the chalk brings away any oil that may be on the surface, and also acts as a polisher.

Those who may hesitate about using the bare hand in the acid water can substitute a soft chamois skin.

From the description given it will be readily seen that the main principle of this process lies in the fact that only a small proportion of shellac likely to soften up is used, and the successive applications of varnish build up a surface first, which prevents the possibility of any oil sinking into the wood to cause sweating-out. It has also brought about a revolution in the method of imparting color or staining. All this must be done before varnish is applied, otherwise it would rub off again, especially along the edges when rubbing down with pumicestone; while if color is used in the French polish on top of the varnish it may soon be found that the acid has a bleaching action on aniline dye colors unless the acid is cleared off extremely dry.

Polish Formula

Varnish Polish.—Shake together well the following ingredients: One quart of boiled linseed oil, one quart of turpentine, one quart of strong vinegar, one-fourth pint of alcohol, and one ounce of butter of antimony. Place in stoppered bottle.

This is the polish so highly recommended under the head of French Polishing, near the end of that article. It is an excellent all-round polish.

Polish for Turners' Work.—Make a paste with pure beeswax and turpentine, and in another vessel dissolve one ounce of sandarach in one-half pint of alcohol, which add very gradually to the wax by stirring. Apply this with a soft woolen rag to the

object as it turns in the lathe, using a dry, soft, old linen rag to polish with.

Water-Resisting Polish.—Place in a bottle one pint of alcohol, two ounces of gum benzoin, one-quarter ounce of gum sandarach, and one-quarter ounce of gum animé. Stopper the bottle and place it in hot water, or hot sand bath. Then add about one-fourth gill of the best clear poppy oil; shake well and then put away for use.

Ebony Polish.—Add one-quarter ounce of the best powdered ivory drop black in one-half gill of shellac varnish. Use a drop or two of the black polish on the inside pad of the rubber, in which case use two muslin covers on the pad.

Polish for Fine Cabinet Work.—Mix together and shake well four ounces each of alcohol, strong vinegar, and turpentine, sixteen ounces of raw linseed oil and one ounce of butter of antimony.

Polish for Dark Woodwork.—Finely pulverize one dram of gum elemi and one-half ounce of gum shellac, and place these gums in a bottle; add two and one-half ounces of alcohol, and one dram of almond oil; when dissolved it will be ready to use.

Or, orange shellac two ounces, alcohol one-half pint, and benzoin two drams. Mix and keep in a well-stoppered bottle, shake occasionally to prevent settling, and keep in a warm place for one week. To use, first saturate the wood with boiled linseed oil, rubbing it well into the wood, after which wipe dry with a clean muslin rag, then rub to a polish in the French polish manner.

Polish for Carved Work.—In one pint of alcohol dissolve two ounces each of shellac and white rosin. Carved parts and pillars of cabinet work must first be coated with copal varnish, which when dry is rubbed with fine sandpaper, to get a smooth surface. Then

apply the polish, using a bristle brush to get into the carved places and standards. Better results follow if the polish and object in hand are both warm; at least the polish should be warm.

Polishing Walnut.—Taking black walnut wood, first make it smooth and clean, and apply the polish to the raw wood; the finish will give all the appearance of rich old walnut. First apply a very thin coat of brown shellac, and at once rub with a piece of smooth fine-grained pumicestone until dry. Then apply another coat of shellac and rub as before. Now it is ready for the polish, which is prepared as follows: Mix together raw linseed oil and turpentine, equal parts, and beeswax enough to make a paste; apply with a rubber. If the surface of the wood is not smooth enough after rubbing with shellac and pumicestone rub it with fine sandpaper until smooth, then rub again with the polish.

Polish for Hardwood.—This formula is rather for cleaning up new furniture, etc., after reaching the place of installation, and also for old work of the same character. Crude petroleum oil is very good for this purpose and is often used by experts when setting up new pews, furniture, etc., but the addition of a gill of alcohol to the pint of oil will improve it.

Polish for Papier-Maché.—The polish used on fine cabinet work (which see) may be used on papier-maché work; apply it with a woolen rubber, using a gentle pressure until the desired polish appears.

White Polish for Light Woods.—Dissolve six ounces of white shellac in one quart of alcohol, and add two ounces of white gum benzoin and one ounce of gum sandarach.

Useful Polish for Dark Furniture.—To one pint of raw linseed oil add one ounce each of rose pink and alkanet root, beaten up in a mortar. Allow

the mixture to stand two days, then pour off the oil, which will form a rich liquid polish.

PIANO POLISHES.—Raw linseed oil thirty-two ounces, butter of antimony two ounces, and eight ounces each of acetic acid, diluted, turpentine and alcohol. Strong vinegar will do in place of the acetic acid.

Twenty ounces of raw linseed oil, two ounces of dilute acetic acid, eight ounces of solution of ammonium chloride (sal ammoniac), and one-half ounce of spirits of camphor. First add to the oil the sal ammoniac solution, then add the camphor and acid, finally adding two ounces of alcohol. Shake well after each addition.

Alcohol ten ounces, raw linseed oil ten ounces, dilute acetic oil or strong vinegar five ounces, nitric acid four ounces; mix and shake until the ingredients are formed into a liquid polish.

POLISHING IN THE LATHE.—There are several kinds of polish used by turners in polishing woodwork on the lathe, and each workman will be found with his favorite way. The following formulas embrace all the best polishes for work on the lathe that we know of.

Take thin shellac varnish and moisten a piece of rag, and lay it over a single thickness of linen or muslin, placing a drop of raw linseed oil on the latter. The oil retards evaporation of alcohol from the shellac and cloth, gives more time for the work, and makes a smoother finish, there being less friction with the grain of the wood. Use either brown or white shellac varnish, as may be required by the color of the wood. Begin the work by adjusting the lathe for low speed.

Another way: Having the lathe adjusted for low speed, prepare the polish from one-half pint of shellac varnish, one-fourth pint of alcohol, and one tablespoonful of raw linseed oil; apply this with a camel

hair brush about an inch wide. Move an alcohol blazer to the wood, do not set it too close, and move it quickly. Wet a wad of cotton with a few drops of raw linseed oil and apply it to the wood lightly, as it revolves; repeat until you have the desired degree of polish.

The third way: Take six ounces of gum sandarach, three ounces of gum mastic drops, and six ounces of best orange shellac, and pulverize; place the gums in a bottle with six ounces of alcohol and shake occasionally until all the gums are dissolved.

For white or very light wood the polish may be made from white shellac gum eight ounces, gum benzoin one one-quarter ounces, and the same of gum sandarach; dissolve in two quarts of alcohol. Place in a bottle and shake until dissolved.

Some rub oil into the wood thoroughly with a wad of cotton before the polishing, removing surplus oil with another cotton pad or rag. A good way is to moisten the rag with some oil, and taking it by its two ends, hold the oiled part against the revolving work, going from end to end until all parts of the object have been well oiled. This may be done until the surface presents a good appearance.

Shred one ounce of genuine beeswax and mix it with turpentine, enough to form a stiff paste. Dissolve one ounce of gum sandarach in one-half pint of alcohol; add this very gradually to the wax by stirring. Apply with a soft woolen rag to the object as it turns in the lathe. Polish with a piece of soft old linen. This will give a very high polish.

Various Polish Formulas

Polish to Stand Water.—Place in a stoppered bottle one pint of alcohol, two ounces of gum benzoin, one-quarter ounce of gum sandarach, and one-quarter

ounce of gum animé. Dissolve by placing bottle in hot water or in a sand bath. Then add about a quarter gill of pure clear poppy oil; shake well, then put away for use, well corked.

Ebony Polish.—Add one-fourth ounce of best dry ivory drop black to about one-half gill of shellac varnish. Use a drop or two of this black polish on the inside pad of the rubber. In this case use two muslin covers over the pad.

Polish for Fine Cabinet Work.—Mix together and shake well four ounces each of alcohol, vinegar, and turpentine, sixteen ounces of raw linseed oil, and one ounce of butter of antimony.

Polish for Dark Woodwork.—Pulverize one dram of gum elemi and one-half ounce of gum shellac; dissolve in a mixture of two and one-half ounces of 90 per cent. alcohol and one dram of almond oil; place in a bottle, shake, and when dissolved it is ready for use.

Here is another formula: Two ounces of orange shellac, one-half pint of alcohol, and two drams of gum benzoin; mix and place in a stoppered bottle, and keep in a warm place for a week, shaking now and then to prevent settling. To use this polish, first rub the wood well with raw linseed oil, then remove the excess oil with a fresh rag, and proceed to polish in the usual manner, French polishing being best.

Polish for Dark Wood Furniture.—To one pint of pure raw linseed oil add one ounce each of rose pink and alkanet root, beaten up in a mortar; allow the mixture to stand two days, then pour off the clear oil, which will form a rich liquid polish.

Polish for Carved Work.—In one pint of 90 per cent. alcohol dissolve two ounces each of seed lac and white rosin. Carved parts and pillars of cabinet work must first be coated with copal varnish, which

is then made smooth with fine sandpaper; after which the polish may be applied. Use a hog bristle brush for applying the polish to the carved parts and standards. Better results follow if the polish and woodwork are both warm when the polishing is being done. At any rate, the polish should be warm.

Varnish Polish.—For polishing work finished with hard varnish. Boiled oil one pint, turpentine one pint, strong vinegar three-quarters of one pint, grain alcohol one-half pint, and butter of antimony one-half ounce; place in bottle and shake well. This is a reviver or renovator rather than a polish, though it does give the work a polish.

Polish for White and Light Woods.—Dissolve six ounces of white shellac in one quart of alcohol, and add two ounces of white gum benzoin and one ounce of gum sandarach. Dissolve in the usual way.

FINISHING NEW FURNITURE

Furniture finishing is divided into three forms, the flowed-on or gloss finish, the rubbed finish, and the polished finish. These for high-grade work.

The Gloss Finish.—The wood is well filled with paste filler and bodied-up with varnish, giving a surface as level and smooth as a sheet of plate glass. The rubbing is done with pulverized pumicestone and water. Oil rubbing is not done on this kind of finish, for it would not give the proper surface for a high-gloss finish. The varnish is flowed on and it is allowed to stand until dry.

The Rubbed Finish.—There is more than one way to do this. Several coats of varnish are applied, with time for each coat to dry; each coat is rubbed with pumicestone powder and oil to remove the gloss and finally to form a good surface. The finer the pumicestone the finer the finish, which will be a dead or lusterless effect.

The Polished Finish.—The surface is prepared as described in the first process, and then it is rubbed with the finest pumicestone powder and water, as water cuts faster than oil and is easier to clean up. When oil is used grit gets into corners and crevices and is very difficult to remove. Not so with water. After rubbing and cleaning-up the surface is rubbed with powdered rottenstone and water, which removes the fine scratches made by the pumicestone rubbing. It is the custom in the best finishing rooms to take some polish and waste and rub the surface briskly, which causes a slight polish to appear. Then a large piece of

muslin is made wet with water and is then wrung out, then it is dampened with a little alcohol and the work is spirited-off. This removes every vestige of cloudiness left by the polish. The best rubbing pad is the human hand. This kind of polishing is done on the best grades of furniture, pianos, etc. Place a little polish in the palm of the hand and rub the surface of the work with a circular movement. It of course requires a skilled workman to do this right, but the effect is an entire removal of every mark left from the former rubbings.

Rubbing requires considerable skill, born of experience, and no description of the process will suffice to enable a layman to do expert work, but it will show him how it is done, and he can practice. The varnish must not be rubbed too much or you will cut through the first coat and ruin the job. The varnish will "sweat" if you rub too close, though most likely the varnish, not the careless or unskilled workman, will be blamed for it. Should this occur, then wait a day or two before rubbing to a finish. If oil is permitted to remain on the work too long it will soften the varnish, which will rub off in spots, especially if the rubbing is done with oil. Allow two days at least for drying before rubbing. Three days is better. Try the surface with the finger-nail; if the varnish dents easily it is too soft for rubbing. If you decide to rub with oil, work rapidly and don't let the oil remain on the work longer than necessary. Some finishers prefer crude oil, and others use coal oil. In any case, the work must be cleaned up with benzine and rag. Then wipe dry with a clean rag. Some think that coal oil cuts faster than water.

Never rub across the grain of the wood, for that will cause scratching. Don't bear on heavily, either at start or finish, or you will get the ends worn smooth;

bear on gently and with even pressure all the way through. Never rub until the varnish is perfectly dry; it will cause sweating when you come to rub again.

Stained work should always be rubbed the way of the grain, never across it nor in a circular manner. That will cause the marks to show at the finish. This is particularly true as regards water-stained work. If the filler has been stained to match the wood that will help to make the work look solid.

The beginner may think that the more pumicestone he uses the faster his rubbing will cut, but that is not so, as he will discover. The proper way is to use very little pumice on your rubber. Rub in a circular manner and evenly, from one end to the other, and once in a while try the surface with the thumb, to note progress of the work.

A felt pad, three by five inches, may be used for rubbing with, but for irregular surfaces prepare a piece of wood to conform to the work, and glue a piece of felt to it; if for water rubbing cement the felt to the wood with shellac. To rub, first dip the pad into the liquid you are to use and then dip it into the pumice. For moldings and carved work roll up some hair cloth until it is about three-fourths of an inch thick, then unravel the ends, making a sort of hair brush.

A box to hold the liquid you are using while rubbing is desirable. Take a piece of board about fifteen inches long, about eight inches wide, and with sides five inches high, with only one end covered, the sides being made to slant or taper down toward the open end. Take a two-pound color can and place in it equal parts of crude oil and benzine; in another can, made quite shallow, place the pulverized pumicestone; or the powder may be placed on the bottom of the box.

Finishing Cheap New Furniture.—It is easy

enough to get out nice looking cheap furniture, but the finish must have durability or that line of goods will not stay on the market. There are many ways of cutting down cost of production, but whatever else is done there must be no cutting down on the filling. This is the foundation and as it is, so is the finish. Nor will it do to put cheap, inexperienced labor on the filling. True, it is done right along. A skilled workman will do twice as much as the inexpert workman, and do it much better, of course. In fact, it takes a good workman to skimp a job successfully.

It goes without saying that only straight-grained wood goes into cheap furniture. Oak of course is meant, with ash and chestnut on the side. To fill such wood allow from twelve to fourteen pounds of paste to the gallon of thinners. Let the filling stand until it has turned gray. Right here is where most filling troubles come in; the filler is rubbed off too soon, it does not have time enough to settle down into the pores of the wood. To wipe it off while green is easier than to wipe when it is partly dry, or gray. Then, too, the filler is not always well rubbed into the wood. Excelsior and shavings are too coarse for rubbing off with; tow is the best thing. Excelsior will take the stuff off in streaks, while tow will gather the filler as you rub and form a good pad.

After rubbing out the filler let the work stand for one or two days; then sandpaper it lightly with fine paper or paper that is partly worn, so that there will be no cutting of corners. It is not often that cheap work gets any sandpapering, but just a slight rub or two will remove any grit, etc., and make the surface very much better, at a very little extra cost.

Let us suppose that the job has left the filling room in good condition. Now we will first-coat it, this being a very important work. This should be a sur-

facer with a silex base. It will make a hard, firm surface, one impervious to varnish, allowing the varnish to hold out well. Such a surfacer is easily applied, easily sandpapered, and covers well. It is, therefore, a very economical and satisfactory coating. After it has become dry enough, apply to it a heavy coat of coach or rubbing varnish.

FURNITURE VARNISHES.—Some of the furniture finishing varnishes contain three times as much oil as gum, and while such a varnish is of course very durable, it never becomes quite hard enough for furniture, being likely to get tacky when subjected to warmth, such as the pressure of the human body against it. There are complaints from furniture makers and dealers that the packing paper sticks to the goods, and it is no wonder, when we consider the soft, oily nature of the varnish it is coated with. But most furniture may be finished with twice as much oil as gum; such a varnish will, in about three weeks, become hard enough to rub. We have finished tables, etc., from the wood up with such a varnish, and successfully. But if extreme durability of finish is looked for it will require months to do work with such a varnish.

Years ago kauri gum was regarded as low-grade stock; it was then the cheapest gum used for making varnish. Furniture varnish was made entirely from kauri. A piece of furniture done with that sort of varnish twenty years previous to this record maintained its high luster unimpaired. Now we hear complaints of polished jobs going dim even before they can be shipped to market. Still, the high dollar will secure the better sort of polishing varnish even now. It is a matter of price, and many will not pay it. A polishing varnish made from Manila gum will of course polish, but the finish will lose its luster in a short time. Kauri gum varnish with some rosin in it

will do the same thing. It also requires longer rubbing to get the polish.

Making Antique Furniture.—Quite a trade is done in making and selling fake antique furniture, or new furniture that has been put through a process that gives it the semblance of very old furniture. Various woods are thus processed, but particularly oak and mahogany. Oak receives a coat of white lead paint, which is allowed to become thoroughly dry. This coating is then removed with caustic potash and a steel wire brush, which not only cleans off the paint, but tears away the softer fibers of the wood, and at the same time darkens it. Sometimes it is necessary to give the work the appearance of having been exposed to strong sunlight for a long time. This is effected by bleaching with either diluted hydrochloric, sulphuric or oxalic acid. When it is required to be darkened it is placed in an air-tight chamber and subjected to the fumes of strong ammonia until it attains to the required depth.

In finishing-off, wax polish containing some burnt umber is applied, and so manipulated that while the flat surfaces of the piece are quite clean, the corners are dirty-looking, this giving the appearance of having been carelessly dusted off for a considerable time. A preparation of butter of antimony is then applied to harden the wax, and the job is ready for the purchaser.

Mahogany is treated in pretty much the same manner as far as the painting and scrubbing off. When the paint is dry and hard it is treated as described for oak, after which the surface is smoothed down with coarse sandpaper, using the hand in manipulating the paper. The result of this work is to remove all traces of the previous operation, and to leave the surface of the wood quite coarse. It is then carefully washed over with a saturated solution of bichro-

mate of potash to darken it, and to develop the figure of the wood. The next operation is to apply several coats of boiled linseed oil, adding to the oil sufficient driers to dry it hard, as the oil alone, though containing a drying agent, may not always dry as desired on this sort of work. When dry and hard sandpaper it smooth and rub with raw oil, or French polish if not too much trouble and expense.

Walnut is done the same way, excepting that carbonate of soda is the darkening agent, in place of bichromate of potash.

REFINISHING OLD FURNITURE

Look the furniture over and ascertain what repairs are needed. The repairs require the work of the cabinet worker. Dents may be putty-filled, and broken veneering may be patched with pieces of old veneering, and when carefully done there will be no visible trace of the repair. After the cabinet man has finished his work it is ready for the finisher, with stain and varnish, etc. Carefully sandpaper all parts that are to be finished, using sandpaper or steel wool. Old varnish that is not solid or in good shape for revarnishing should be removed. This may be effected by means of varnish remover, if the varnish is tough; if dry and quite brittle it may be removed by scraping or with sandpaper; sometimes dry varnish can be taken off very easily by coating it with hot varnish, which, in drying, will contract and pull off the varnish in flakes; this requires a dry, warm room, and several hours; usually over night will do it. Liquid removers may have to be employed, and are very efficient, though messy and disagreeable to handle. Alkalies and alcohol, benzol, and some other liquids will take off old varnish, according to the toughness or hardness thereof.

After removing the old varnish, where that may be necessary—and where the old varnish is in good shape it will not be necessary—sandpaper and make smooth the surface and clean off dust. Now look up parts that may require coloring, to make uniform with the main part of the work. My own method is to apply a colored oil stain all over the work, the stain being one

that is similar to the color of the wood, and then to rub and remove the surplus stain. This evens up the coloring, and is left to become dry, japan driers having been put in the oil. Should there remain any parts after this that are lighter than the general surface, touch up such parts with an oil stain. When dry, go over the entire job with curled hair or moss, to take off gloss and specks. Then the finish may be applied, varnish usually. If only one coat is to be applied, let that be heavy, flowing it on, and brushing it out well, brushing out even and level. Use good furniture varnish. If two coats are required, let the first be rather light, and after forty-eight hours rub down lightly with fine steel wool or fine sandpaper; then dust off and apply a full coat of furniture varnish.

As regards both the amount of work and the quality of varnish used, it will depend upon the character of the job, whether cheap, costly, or medium.

There are several grades of furniture varnish, and as comparatively little suffices for the average job it would seem to be the best policy to use the best. However, the medium grade will do very well in most cases. Furniture is usually given a luster finish, no rubbing on the last coat.

Some old furniture may require simply a light sandpapering, using very fine paper or steel wool, finishing with a coat of light-bodied varnish. Or it may do with a mere clean-off, using a rag with some reviver or renovating liquid, for which purpose there are several formulas. First of all it may be best to wash off with water and soap, then wiping dry. The actual condition of the furniture will of course indicate the method for its improvement.

The refinishing of old furniture forms a large and profitable trade, and it is important to know how to do such work at the minimum of time and expense;

yet I would not advise a close estimate, nor advise the use of cheap materials, unless it be for very cheap jobs. A little varnish goes a long distance on furniture, and the cost will not be great even where the best grade is used. You can use a cheap rosin-adulterated varnish that will dry quickly and give a handsome luster, but such a finish will not prove satisfactory in the end.

Enameled Furniture.—After cleaning up and making smooth with sandpaper, which will also give proper tooth, apply a coat of enamel paint, white or any desired tint. This may be bought ready for use, in best and medium grade; if for very cheap jobs you can obtain what is known to the trade as Special Varnish quality; some varnish makers put out a very hard-drying yet fairly elastic enamel paint. Of course the paint may be made in the shop, using zinc white and either white damar or pale copal varnish. The zinc white should be either ground in varnish or be dry. Some cheap work may be done, however, with white lead and zinc white, in oil, thinned out with turpentine, adding a little bleached linseed oil, or poppyseed oil, with some white japan drier. This is for the first coat or ground. Rub smooth, dust off, and apply a coat of white enamel, made from zinc white and damar varnish. The ground just described will do also for the doing of a first-class job. Over it apply two coats of quick-drying flake white, in oil, thinned with turpentine, sandpapering the last coat smooth. Apply a coat of white enamel, which may be bought, using the best grade, or may be made, using the best grade of French process white zinc, ground in hard white enamel varnish. A coat of this should stand three days, then rub down white fine pumicestone powder and water; in twenty-four hours apply another coat of this enamel, and let it stand two or three days, to

dry. Then moss off and rub with curled hair and pumicestone powder and water. Wipe dry, then polish with powdered rottenstone and sweet oil, if the surface is quite smooth. If not smooth, it will be better to apply another coat of the enamel, which may then be polished. This should produce a surface smooth as plate glass. The enamel may be tinted any color desired.

Cheap work may be done with much less labor, for the first or ground coat may be of glue size and whiting. One coat of this will do on some work, as it is done in the factory, but two coats will make a better foundation for the enamel paint.

A clear varnish for enamel paint may be made by adding two quarts of strong denatured grain alcohol to four gallons of damar varnish, shaking the mixture well. This varnish will appear rather dark, but it will not affect the white enamel; its purpose is to get rid of the opalescence of the damar, and the result is a clear, transparent liquid, which also causes the varnish to dry harder than it would if not thus treated.

Another clear varnish may be prepared by dissolving one pound of gum sandarach and four ounces of clear Venice turpentine in four ounces of 94 per cent alcohol on a hot water bath, with gentle heat. When the gum is dissolved and while yet warm filter through fine muslin.

Repolishing.—When a piece of cabinet work or furniture requires repolishing it is best to take the article apart, if possible, for this will facilitate the work and permit of a cleaner and more thorough job. Remove fixtures, such as the handles, etc. Rust-dirt under these parts may be removed by rubbing with a paste made from fine emery flour and turpentine. Then clean up the whole surface of the work, using soap and water, or acid, or whatever will do the cleaning best.

Then apply a coat of clear raw linseed oil, adding a little color to match the wood, then rubbing off dry all that a rag will remove. This will give uniform coloring and make a better ground for the repolishing. Repair broken or other faulty places. Dents or fine cracks may be filled with shellac by repeated coats, or with a specially prepared putty, that must be made to dry quick and hard, so that it may be sandpapered well.

Coloring Up.—The principal colors employed by polishers for "coloring up" are black and red. The black polish may be made by mixing lampblack with thin polish (half polish and half alcohol). Strain this through muslin. Or you may use a little aniline spirit black with thin polish. This is the handiest way, but is not so permanent as the lampblack or gas black polish. Red polish may be made by mixing Bismarck brown with thin polish. This is the red polish mostly used by the French polishers.

Having prepared the color, mix a little of the black with the thin polish until the desired depth of color is obtained; be careful not to get it too strong. In coloring it is better to apply two or three coats of weak color than risk getting it too dark; in case, however, the work is too dark wash it off with alcohol. And now, assuming that the light parts are dark enough, yet we find that they are not the same shade as the other parts, not brown enough, let us say. We may remedy this by mixing some of the red polish with some thin polish, as we did with the black, and color with this. As these colors are transparent, one color will show through another, so by coating the black with the red we get a brown.

Furniture Polishes.—The character of the work and the furniture will determine what kind of polish should be used when it is desired to revive the finish. One of the most popular polishes, and easiest to make

and manage, is that made from beeswax and turpentine, the product having the consistency of soft butter. The mode of application is too generally known to require a description here, yet some mention must be made. The wax is taken up on a bit of rag or cloth, and is well rubbed on to the object that is to be renewed, after which, allowing a little time for it to set, it is well rubbed with a clean piece of woolen rag until a fine polish appears. In some cases rubbing with a stiff bristle brush is advised.

Wax finish is not the most durable; for one thing it is easily affected by water or dampness, which turns it white or pale. A better finish may be made from three or four pieces of gum sandarach, about the size of a black walnut, and adding one pint of boiled oil, boiling the whole for one hour or so. Then remove from the fire and allow it to cool; then add a dram of Venice turpentine; if too thick add a little pine turpentine. Give the furniture a coat of this and let it stand for a few hours, after which rub off clean. The furniture then should be rubbed at frequent intervals to keep it clean and fresh, but it will not be necessary to renew the polish more than once every three or more months. Any scratches on the furniture may be removed by rubbing in a little of the polish.

Doing-Up Old Furniture.—An expert gives the following as his method of doing-up old furniture: Place in a quart bottle the following ingredients, and in the order given: One gill of powdered rottenstone, one gill of raw linseed oil, one gill of turpentine, one gill of benzol, one gill of a strong solution of oxalic acid, one-half gill of alcohol, and one gill of cold water, to which has been added gradually a teaspoonful of sulphuric acid. Dip a piece of felt into the mixture, having poured out some into a saucer, and rub the work in a circular manner, beginning at one part and

slowly working toward the opposite part, in the usual manner. Do not rub too long in any one place, and do only a portion of a surface at a time. On some surfaces flour pumicestone may be used in place of rottenstone, which is not as abrasive as the other powder. This polish is said to remove white marks from varnished surfaces.

Furniture Cream or French Repolisher.—In one pint of 95 per cent. alcohol put one-half ounce of gum copal; first powder the copal and pass through a fine sieve or cheese-cloth; then add one ounce of shellac, flakes or pulverized. Place in a stoppered bottle and keep in a warm place, shaking occasionally to facilitate dissolution. The gums should be all dissolved in two or three days. Then strain through cheese-cloth and bottle again, keeping bottle well corked.

Furniture Revivers.—Wax does not do so well on French polished work, but does very well on other finishes; for use on some woods it is well to add a little coloring, say red sanders wood. For reviving French polished work try this: Take equal parts of turpentine, strong vinegar, alcohol, and raw linseed oil, placing these in a bottle in the order given. This is necessary in order that curdling may be avoided. Curdling will spoil the mixture. The formula given is said to be a very superior one.

For French polished work the following very old and still popular reviver will please you: Beat up gum Arabic and whites of two eggs in a mortar or other suitable vessel until they amalgamate. Then add one-half pint each of raw linseed oil and pure strong vinegar, eight ounces of alcohol, one ounce of hydrochloric acid, and two ounces of butter of antimony. Rubbing with this mixture will give a good polish, one that will prove lasting as well as pleasing.

Here is another formula: Pulverize one ounce of

shellac gum, two drams of gum guaiacum, two drams of dragon's blood, and two drams of gum mastic, place the whole in a bottle and add one pint of alcohol. Place the bottle in a warm place, shake occasionally, and when dissolved strain through cheese-cloth, bottle it again, and add a tablespoonful of raw linseed oil and shake all together. This polish is intended for the darker woods, for it would discolor the lighter woods. It is especially fine for cherry and mahogany, on account of the reddish hue imparted by the dragon's blood.

Furniture Renovating Polish.—Melt in a vessel that is to be placed in another vessel containing hot water, white wax one-half ounce, pale rosin one-half ounce, and Venice turpentine one-quarter dram. Stir until the mass is dissolved. Then pour out into another vessel and while it is hot pour into it five quarts of turpentine. Let it stand two hours, then it will have assumed the consistency of vaseline or soft butter. Having made the furniture or piano clean, rub on the polish with a bit of soft rag, rubbing to a polish with felt or dry cloth.

Another formula: Melt together at a gentle heat three ounces of turpentine and four ounces of white wax, in an earthen vessel, covering it to retain the fumes of turpentine. Allow the mass to cool until it is almost firm, then add two ounces of alcohol, and mix well together.

Still another one: Melt together two and one-half ounces of yellow wax, one ounce of white wax, one ounce of Castile soap, ten ounces of turpentine, ten ounces of boiling water, and one dram of potash. The best way is to melt the waxes and the turpentine together, and separately dissolve the soap and potash in the hot water by boiling until the soap is dissolved, and then stir in the wax and turpentine compound

while the latter is still hot. After removing the mass from the fire continue stirring it until it is cold, to prevent the wax from granulating.

Derby Cream.—This very old and reliable reviver is made by adding six ounces of raw linseed oil to three ounces of acetic acid; stir well, then add one-half ounce of butter of antimony and three ounces of alcohol.

Wax Stained for Colored Woods.—Shred and melt four ounces of beeswax in ten ounces of turpentine, and color it with alkanet root. The root may be put in the turpentine to digest the color before putting the wax in it. Melt the wax in turpentine, over a water bath. Stir the mixture while it is melting. Aniline may be used in place of alkanet root.

Or, linseed oil ten ounces, white wax one pound, white or pale rosin one ounce; stain with alkanet root, one ounce; steep the root in the turpentine. First melt the rosin, then add the oil by stirring. Then melt the wax and add it to the oil and rosin mixture. Finally stir in the alkanet coloring.

Or, melt together four ounces of beeswax and one ounce of rosin, and add two ounces of turpentine, with dry Venetian red to color the mass.

Polish for Good Furniture.—Melt one pound of yellow beeswax in one pint of raw linseed oil, on a water bath, and after taking it from the bath stir in one gallon of turpentine. This will give a thin polish, useful for restoring old furniture. First clean the furniture and apply the wax with a soft woolen cloth, after which rub to a polish with a woolen or silk cloth.

Renovating Piano Polish.—Melt together one-fourth ounce of Carnauba wax, two ounces of Japan wax, and two ounces of yellow beeswax; add kerosene oil sufficient to form a mass about the consistency of soft butter. The waxes are melted together first, then are left to cool a little, after which the kerosene oil

is stirred in. Now let the mass become cold, and if it proves to be too solid it must be remelted and a little more kerosene oil be added.

The Carnauba wax gives a high polish, while the two other waxes make the mass more elastic or flexible.

Cheap Wax Polish.—Dissolve one-fourth pound of pearlash in one quart of boiling water, and while boiling add and stir in one and one-half pounds of shredded beeswax; stir until dissolved, and add water occasionally, to make the mass the consistency of good cream. As it will thicken some upon cooling it will be necessary to add water while using it, to maintain a uniform consistency. Apply as you would varnish, and after it has become dry polish with stiff bristle brush or cloth.

Polish for Statuary, Etc.—The wax polish just described will do for statuary, plaster casts, white marble, etc., only it will be necessary to substitute white wax for the yellow.

Perfuming Polishes and Renovators.—Many furniture polishes and renovators have an unpleasant odor, and to overcome this certain perfumes are added. Any essential oil will do for this purpose, but oil of mirbane is most generally employed. It is not expensive, being the artificial oil of bitter almonds. Oil of wintergreen has a pleasing odor, while such oils as those of origanum, thyme, etc., may be used. The high cost of many other pleasing odor oils debars them from being used.

Lemon oil has the familiar odor of lemons, and it is one of the best for our purpose, as it acts as a strong detergent. Its cost, however, makes it impossible for our use. Many of the essential oils act in the same way as lemon oil. Place some oil of this class on a rubber and rub a varnished surface with it, and it acts like curled hair, dulling the surface of the varnish.

Used in connection with rubbing oil it is said to save a third of the time required for the rubbing. When used in this way the surface should afterwards be well cleaned off.

Various Furniture Polishes

For Old Rosewood.—Place in a vessel ten ounces of yellow wax, one-half pint of boiled linseed oil, and one ounce of boiled alkanet root; place the pan in another that is three-fourths full of boiling water, leaving it there until the wax has melted and the whole has been well colored with the alkanet. Strain, and when cool add to it one gill each of strong vinegar and turpentine, mixing the mass well. This "fetches up" old mahogany as well as old rosewood, and indeed any dark colored wood.

For Old Oak Furniture.—Dust the furniture carefully, then wash with Castile or any good white soap, forming a suds with the soap (and soap flakes are even better), after which rinse and let dry. Then rub with thin wax polish, using a soft woolen rag to get a polish. Plain surfaces may be nicely polished by rubbing with the palm of the hand, the friction generating a little heat which, combined with the natural oil of the skin, produces a very fine polish.

Avoid too Much Renovating.—Furniture suffers more from overpolishing than from neglect. The amateur applies too much polish, and then fails to rub off the excess; in this manner the surface gets a coating of some thickness, detracting from the beauty that may have existed there. Some pieces of old furniture have a delicate finish, obtained by much hard rubbing. The secret of repolishing old furniture, etc., lies in careful cleaning and dusting, then an application of the renewer or polish, this being very thin, and the coating

very thin; follow with a rubbing with a dry soft woolen rag or an old silk handkerchief, until the surface is so hard and clear that passing the hand over it will leave no mark.

The old furniture that has been badly used and long neglected will require much work to get it in prime condition again. If the polish is too thickly applied it will make a soft, smeary job and a perfect dust trap.

Splashes of dirt on the furniture may be removed with soap and water, following with clear water for rinsing, then when dry rub with a mixture of alcohol and raw linseed oil, equal parts, or with alcohol and turpentine. These mixtures have a cleansing effect, in addition to giving the object a polish. Rub the fluid well, and then rub off any surplus with a dry rag. A similar liquid polish may be made by adding a little stearine with turpentine and alcohol; if too much stearine is used there is likely to be white streaks in the mass. After the turpentine and alcohol have evaporated give the surface a good rubbing with a dry woolen cloth. This will give a good polish that may easily be renewed when dim.

Here is an old home-favorite polish: Shred fine two ounces of Castile soap and two ounces of beeswax into a jar, with one-half pint of water; set the jar in a moderately warm oven until the soap and wax are dissolved. Then set aside until cold, when there is to be mixed into it one-half pint of turpentine and two tablespoonfuls of vinegar; stir well. Stir the mass occasionally while it is in the oven.

The principal ingredients of most furniture renovators and polishes are turpentine, raw linseed oil, vinegar, or acetic acid, alcohol, and butter of antimony. Many of the commercial polishes are simply linseed oil, turpentine, and strong vinegar, equal parts, and

this makes as good a liquid as can be desired for the usual run of old furniture. There are also other substances, solid and liquid, used in making up polishes or renovators, as the following list will show.

Crude petroleum and also kerosene or coal oil. The crude oil is very useful in cleaning up new furniture after it has come from the store, and for church furniture, pews, etc., after it has been set up. It cleans and brightens up the varnished surface. It was once recommended to me by an old workman, as he was renovating the pews, etc., of a church. As the oil evaporates in time, it leaves a dulled surface, which must then be rubbed well with a dry rag, to produce a polished effect.

Mix together one pint of raw linseed oil, two ounces of camphor spirits, four ounces of strong vinegar, one ounce of butter of antimony, one-half ounce of liquid ammonia, placing the ingredients in a well-stoppered bottle; shake well before using. Apply with a soft cloth, and rub to a polish with woolen rag or old silk.

Olive or sweet oil eight ounces, oil of amber eight ounces, and tincture of henna one-half ounce. The henna colors the polish. Keep in corked bottle, and shake before using. Apply with a soft brush or cloth, and rub to a dry polish with soft cotton cloth.

One quart of strong cider vinegar, two ounces of butter of antimony, two ounces of alcohol, and one quart of raw linseed oil; shake well before using.

Acetic acid two drams, oil of lavender one-half dram, alcohol one dram, and raw linseed oil four ounces. Mix and use as generally directed.

Equal parts of boiled linseed oil, turpentine, and white vinegar. Very good for removing scratches.

"Furniture paste" is made as follows: Dissolve six ounces of pearlash in one quart of hot water; add one-half pound of white beeswax; place all in an earthen or

enameled vessel, place on stove and let it simmer for about thirty minutes. Then take from the fire and when it is cool skim off the wax. When required for use add a little hot water to the wax and work it into a paste.

Raw linseed oil one pint, shellac varnish four ounces, turpentine two ounces, alkanet root two ounces, and shredded beeswax two ounces. Steep the root in the oil to extract the color.

Mix well together one pint of raw linseed oil, one-half pint of shellac varnish, and one-half pint of alcohol.

Acetic acid two drams, oil of lavender one-half dram, alcohol one dram, and raw linseed oil four ounces.

Raw linseed oil one pint, alcohol two ounces, butter of antimony four ounces.

Raw linseed oil one pint, rose pink one ounce, and alkanet root one ounce; macerate the root in a mortar or other suitable vessel, and place in the oil, to extract the color.

The formulas given are old, though none the less useful for that reason; but it should be noted here that such coloring matters as henna and alkanet root while desirable on account of their durability of color, can be replaced by the coal dyes or anilines, and are so replaced, though not with entire satisfaction, owing to their fugitive nature as colors.

Coloring is useful where any of the dark woods are to be treated, selecting a color to agree best with the particular wood or finish in hand. But where the object is simply to revive the luster, or clean and give new life to the finish, the coloring is of course not necessary.

The purpose of an acid in a renovator is to clean dirty surfaces, hence if the furniture has been washed

clean with soap and water there will be no use for an acid in the mixture.

Wherever alcohol is indicated in a polish or renovator the denatured article suffices, for even though it should contain kerosene it would not vitiate its usefulness; and if the denaturant is wood alcohol, no matter. But in all cases the use of grain alcohol, even the denatured, is advised. When grain alcohol has been denatured with, say, ten per cent of methyl or wood alcohol, it is often referred to as methylated spirits; our British cousins use this term.

Removing Stains, White Spots, Etc.

White Spots.—White marks on furniture, occurring most frequently on polished table tops, may be caused by dampness, water, or alcohol. They are removed usually with difficulty, though an expert, whose word I have the greatest confidence in, states that he has often successfully removed white spots by rubbing them with a rag containing salted butter. The rag is folded to form a sort of rubber, and the spot is rubbed briskly. He also recommends holding a heated sadiron over the spot, being careful not to heat the surface enough to soften the varnish. Then polish with raw linseed on a rag. The secret of this method lies in the fact that the heat of the iron is dry, not moist, and it gently fuses, to some extent at least, the gum of the varnish, and thus causes the white to disappear. White marks made by hot dishes are caused by a moist heat, but a dry heat removes such marks.

Other methods have been used with more or less success, a few of which follow:

As soon after the white spot has been made as possible apply diluted oxalic acid; follow by rubbing with either sweet or linseed oil.

Rub the part with spirits of camphor until the whiteness disappears. Then rub with oil.

Camphorated oil may be used, rubbing the part as with the former liquid. Camphorated oil is simply sweet oil and camphor spirits, mixed. This, by the way, is sometimes used as a renovator.

Apply a mixture of oil—linseed, cottonseed, or sweet oil—mixed with salt, spread on thinly, and left on for about one hour. Then remove it with a rag, and rub the spot dry.

One man tells us that he uses a hot iron, but follows with a polish made from raw oil, vinegar, turpentine and alcohol, well mixed and rubbed on, the same as when renovating.

White marks on mahogany, caused by dampness, should be well rubbed with a soft rag moistened with a little sweet oil.

Water will spot a varnished surface when the varnish contains rosin, and there is nothing in the way of a cure save to revarnish it. Some say that a liquid prepared from two ounces of oxalic acid, one ounce of butter of antimony, and one pint of water will remove the blemish. Doubtful.

Alcohol marks are best treated as soon as possible, washing off the spilt alcoholic liquor, or other beverage, and then sprinkling some dry powdered sal soda over the part affected most, allowing this to remain a few moments; then wipe dry and rub with a rag dampened with kerosene oil; after this rub the entire top with the rag and soda, following with a rub with a clean cloth. If the beverage has been washed off immediately there should be no trouble with spotting. If the spot is old, follow the same procedure, wetting the part with water and dusting on the soda. But, as stated, white spots, no matter how caused, are not easily remedied; the surest way is to remove all the

varnish from the table top and revarnish or polish. Where the finish is in oil, by rubbing, the hot dish or alcohol does not damage the piece very much.

Bloom on Varnish.—A blue-gray film sometimes mars the finest polish finish, and this may be removed by rubbing with water to which a little vinegar has been added, about a tablespoonful of vinegar to one quart of water. Saturate some cheese-cloth with this liquid and wring out as dry as you can. Rub the polished or varnished surface with this cloth, being careful to rub lightly, to avoid marking the varnish, and follow with drying the surface with a dry, clean piece of cheese-cloth. If this should happen to fail, follow in about a week with a repetition of the operation, when success ought to follow and the article look bright and new.

Renovating Dull Finish.—Gas, coal and illuminating, with dust and dampness, cause furniture to assume a dingy appearance, to remove which wipe off with a cloth dampened with benzine; let the work stand then for an hour; then make up suds with a good white soap, or soap flakes, and with a soft cloth wash the furniture, following with clear water; when dry polish with a soft dry cloth.

Finger Marks on Piano.—Clean off with water made slightly acid with strong vinegar or acetic acid. Alcohol is also a good cleanser, but must be used cautiously, as it affects the varnish easily. A quick passing over the work with a slightly dampened cloth is called for.

Greasy Appearance after Polishing.—Renovators or polishes containing oil are apt to leave a greasy film unless carefully removed at the time. This may be removed with vinegar or acetic acid, diluted.

Discolored Woods.—Woods that are naturally discolored, that is, have dark parts with the light, cannot

well be remedied, though a bleach may do it. But accidental discolorations may be remedied with strong solution of oxalic acid, or one part of hydrochloric acid with five parts of water. Ink spots may be treated with oxalic acid, or try spirits of nitre, or nitric acid. Using the latter acids, the spot will become white, and as soon as it does this wipe off with a soft dry cloth. It may be necessary to give two applications, but the acid will finally take away the spot.

Bleaching Out Stains.—There are several acids used for bleaching out stains on woods, vinegar or acetic acid being the most common. For very dark stains oxalic acid is preferred. Vinegar and acetic acid may be used full strength, but oxalic acid should be reduced with water, say, one pound to the gallon of water, though it must sometimes be used stronger than this, say, one ounce to the gill of water, it all depending upon the kind of stain to be removed. Vinegar or acetic acid is sometimes added to the oxalic, though why is not very clear. The solutions are used hot, warm or cold, as preferred. A little zinc put in some hydrochloric acid modifies the acid and this is used as a wood bleacher. Nitric acid, diluted with water, is another acid bleacher. It is sometimes used after oxalic acid has failed to bleach. A method of using bleaching agents to remove stains from wood is to first apply oxalic acid, then sandpaper the part and then apply a mixture of caustic lime seven parts, and sal soda one part.

Stains from iron rust may be removed with what is called Russian water, which is made from oxalate of tin in diluted oxalic acid.

White Marks on Wax Finish.—When water lies on a waxed surface long enough it will turn the wax white, the effect of the water uniting with the wax. The remedy is to rub the parts with a rag moistened

with alcohol, after which rub with a little oil, linseed or sweet oil. This will remove the white blemish, but one should be careful not to let water lie on a wax finish.

Protecting Wax Finish from Water.—If the finish is liable to come in contact with water or dampness it may be protected with a coat of this liquid: Mix together six parts of copal varnish, six parts of boiled linseed oil, and ten parts of turpentine, all by weight. Use Zanzibar copal varnish if convenient. This coating will preserve the finish against water and not alter the appearance of the finish.

Cleaning Dirty Hardwood Finish.—If there is much grime and dirt, so that ordinary soap and water washing will not remove it, soak it with kerosene oil for an hour or so, to loosen up the stuff, then rub it off with a rag, and wash with strong soap and water. Then rinse and wipe dry. Then rub with crude oil, followed by polishing with a soft rag. But if the work will not finish up clean by the method given, apply more crude oil to the bad parts and sprinkle some pulverized pumicestone over it and rub it; rub gently and regularly, first with a circular motion, then with the grain of the wood. When the surface has become smooth and bright wipe off and finish as indicated after washing with soap and water.

Sticky Pews.—Sticky varnish on church pews is not caused by poor varnish as a rule, though a cheap varnish, containing rosin, could produce this condition. The air of the average church building is damp and impure, there being little or no ventilation, and the air reeking with ammonia and perhaps coal gas. The trouble sometimes comes from revarnishing over greasy surfaces. The parts that come in contact with the body or hands of the pew's occupant in time become greasy, and to varnish over this means undry

varnish. Before revarnishing, the seats and other parts that come in contact with persons should be washed with soap and water, or with water containing some sal soda, using hot water.

There is a grade of varnish specially adapted for church pews, and is called pew varnish; it is made with hard copal gum, and is rather short in oil. This is the varnish that should be used for the purpose, though there are others that will do very well, being made from a hard copal gum.

The best cure for sticky pews is the removal of the varnish. This may be done with some caustic or with varnish remover. It is a large job, but effective. Some coat the old varnish with shellac, used very thin. Over this apply a coat of pew varnish. Some advise rubbing the sticky varnish with drying japan, but this is a poor way.

Cleaning Dirty Varnished Surface.—This subject is treated under another head, but the present case is that which comes under the notice of railroad men, who have to deal with cars that become very grimy in certain parts. To remove this grime they use a paste made as follows: Starch or flour forty parts, hydrochloric acid forty-five parts, chloride of lime fifteen parts, and turpentine one-half part; mix thoroughly to a paste. Cover the grimed parts, whether of stone, wood or metal, and let remain on for some hours, testing it now and then after that time, to see how the work comes on. When it has loosened up all the dirt and grime remove the stuff by rubbing briskly with cloth or brush, when the work will come out clean and bright. The lime chloride keeps the paste moist, and permits the removal of the paste without injury to the surface of the varnish.

Removing Specks on Rosewood Piano.—The minute specks seen on rosewood with varnish finish are

caused by an oil that exudes from the wood, and which shellac and varnish fail to hold back. They greatly disfigure the finish, and the only remedy is to sandpaper and refinish.

Fine Cracks on Mahogany.—When mahogany finish shows a number of fine fissures, impairing the finish, they may usually be removed from sight by rubbing into them a putty made from dry Venetian red and gum Arabic mucilage. This method will do for any other wood, only making the color of the putty to suit the wood or finish.

Pitting of Varnish on Piano.—Make a hard wax polish with one-half ounce of Carnauba wax, two ounces of Japan wax, or white beeswax, and two ounces of seresin wax; melt all together on a water bath; when melted add some kerosene oil, enough to make the wax compound about like vaseline; if it becomes too hard, upon cooling you may add a little more kerosene. Apply this with a woolen pad, giving as many applications as may be required to fill up the tiny pits.

Restoring Color to Old Mahogany.—Add one-half ounce of alkanet root, cut up in small pieces, to one pint of raw linseed oil, in which let it stand for one week, to extract the coloring. Then add one-half ounce of powdered gum Arabic and one ounce of shellac varnish; place in a bottle and keep in a warm place for a week, then strain it. Wash the surface of the wood with slightly soapy water, rinse with clear water, wipe dry, and polish with the wax, using a soft woolen rag.

Furniture Bruises.—If the bruise goes down into the wood, wet it with warm water; this will raise the sunken part to a level with the general surface; after allowing the part to become dry, sandpaper it smooth and level. Then stain and putty, if this is necessary.

Another way is to fold some brown paper and wet it, laying it on the bruised part and holding a hot iron over it until the water has been evaporated from the paper. It may be necessary to repeat the treatment. A small bruise may be cured by wetting the part and holding the hot iron over it.

Using the Chamois Skin.—Never rub a varnished surface with a dry chamois skin or wash leather, for it is very apt to scratch the varnish. The dry skin gathers dust and specks of dirt, and these mar the varnished surface by rubbing, besides which dry skin is harsh.

Removing Old Varnish

Though very efficient, the commercial removers of old varnish are costly, and in some cases quite out of the question on this account. But if you use them, then avoid waste. The proper way to use them is as follows: First, coat the surface all over, and not in patches; let the remover have time to work before beginning to remove it. Try it now and then, to ascertain how it progresses, and if it shows that the old varnish is loose, then begin to scrape it off; if it is not loose enough, then apply another coat. The common mistake is to begin scraping before the liquid has had time to soften the varnish down to the wood. To soften a patch at a time and remove it is a waste of time and remover. Keep the can well corked, as the liquid is very volatile. Such are the directions given by a manufacturer of removers. The remover acts somewhat slowly, but in time will eat clear to the bottom of the varnish. Very hard varnish is more difficult to remove, and requires a longer time than newer or softer varnish.

Where a scraper cannot be used, as on certain parts, work the brush that is used for applying the remover

back and forth, or use a wire brush or coarse steel wool. After you have taken off all the old varnish take benzol, or benzine, or denatured alcohol, or just benzine, with a little of either of the other liquids added, and clean off all the old stuff until the surface is clean.

By adding some paraffin or other wax to the liquid remover evaporation is retarded; hence the can of remover should be shaken before using, to mix the wax and liquid together. Also by means of this retarder, wax, it is possible to use it on upright surfaces, and to work in the open air.

Alcohol Remover.—Varnish, after its turpentine content has evaporated, is mainly a vegetable mass, and hence is easily dissolved by alcohol or alkali, and by several other liquids. Alcohol does well for small objects, affecting the varnish at once, but not eating through thick coatings very quickly. Its slow action makes it less desirable for larger surfaces that are coated with oil varnish, but for shellacked surfaces it is to be preferred. For certain delicate work alcohol, to which has been added a little camphor gum, is useful; rub the part with this liquid briskly, and when the coating has become soft enough remove it by washing with soapsuds. Alcohol and banana liquid together make a very effective remover.

Fusel Oil Remover.—These removers are very volatile and injurious to the user. They are also inflammable and explosive. Fusel oil forms the basis of ethers, guncotton, collodion, banana liquid and cheap whisky. It is a poison and should be handled with due care, or only by those accustomed to handling it. Yet it is a powerful varnish remover. It is also useful for cleaning old paint and varnish brushes, and for removing tar, shellac, copal varnish, lacquer, paint, etc. Some say it will injure the hog bristle

brush by destroying its spring or elasticity. When used in the shop or house there should be as much free air as possible, having doors or windows open to admit fresh air. The same may be said respecting any other of the varnish removers, wood alcohol being the worst offender of the lot.

Usually fusel oil is not used by itself, but some other suitable liquid is added to it, the following typical formulas showing this: Mix together four ounces of benzol, three ounces of fusel oil, and one ounce of denatured alcohol. Increase these proportions for larger quantities. Another formula calls for wood alcohol in place of fusel oil: Benzol three quarts, wood alcohol one quart, and paraffin wax eight ounces. Melt the wax in one-half pint of kerosene oil, add this to the other liquids and stir all together. This is a good, cheap and easily prepared remover.

Banana Liquid.—From fusel oil we obtain amyl acetate, which in turn yields banana oil, so called because of its odor, which is a very good imitation of that derived from the banana fruit. Amyl acetate is prepared by distilling a mixture of one part fusel oil with one part of concentrated sulphuric acid and two parts of potassium acetate. The distillate is first washed with water, then with a dilute solution of sodium carbonate, and is finally rectified after being dried over fused calcium chloride. Amyl acetate is insoluble in water, but is miscible in all proportions with alcohol.

As banana liquid dries or evaporates very rapidly it is not well to take too large a surface at a time, but apply to a small area and remove stuff as soon as it is soft; then do another small space, adjoining the first space, and so continue until the whole is done. It is well here to remind you that after the treated part has become soft enough for scraping off it should be done

at once, for if allowed to stand too long the mass will become hard and will have to be coated with remover again, thus doubling time and trouble, and also wasting remover. This will apply indeed to all the liquid removers.

The odor of banana liquid is disagreeable to most people, but it does not injure the skin nor the brush, and it is very efficient on old varnish. It eats right down to the wood, and into the filler, if permitted. A less energetic remover should be used for work that has a light coating of varnish, or if only the upper part of the coating is to be taken off. The liquid will not injure wood, but if allowed to go too far will eat into the wood filler, which should be left intact. After the remover has done its work rub off with rag and benzine.

Alkali Removers.—Alkalies are cheap and very efficient, but hard on the skin, also on any painted or varnished work that should not be injured. One pound of sal soda to the gallon of water will give a good remover, though it may be used stronger if necessary. Apply freely, and while the surface is still wet begin to scrape with the steel brush or with steel wool, brushing out corners, etc., with a stiff bristle or steel wire brush. When the work is done wash off with clear water, following with diluted vinegar, to neutralize the alkali. Then wipe dry with a cloth, or as nearly dry as you can, leaving it to finish drying by evaporation.

Ammonia water is good, and especially for cleaning out corners, beads, etc. For removing filler from the wood ammonia is very useful. But as ammonia darkens some woods in such cases you will have to follow with a bleach, as described in another place.

A permanent emulsion may be made from ammonia two parts and turpentine one part, shaking together.

Potash with fresh lime, and sal soda with lime, with water, form good removers, but are very caustic. A powder may be made from caustic soda, one-eighth part, powdered lime three-eighths parts, and whiting two-eighths parts; keep this powder in a dry place, and when wanted for use add water to form a paste like thick cream; this is spread on the old varnish and allowed to remain thirty minutes, to eat into the varnish, which may then be scraped off. This powder, when mixed with water, one pound to the gallon, makes a fine cleanser for a dirty varnished surface.

Formula for Commercial Remover.—There is more than one formula for making commercial remover, and the following is given merely to indicate how such remover may be made. Pure crystallizable benzine 200 parts; denatured alcohol 200 parts; acetone 50 parts; paraffin wax 25 parts; common yellow rosin 25 parts; carbon disulphide 25 parts; and amyl acetate 5 parts. Dissolve the wax in the benzine, which has been made hot on a water bath, adding the other ingredients afterwards. By omitting the wax we have a liquid remover. For some purposes the liquid remover is preferred.

Carbolic acid is a strong varnish remover, and some years ago was much used, but it is now replaced by less harmful agents. It is not safe to use, being so caustic, burning the flesh when in contact therewith, and it was impossible to use it and escape contact. Yet it was the principal thing in removers at first, the crude acid being used, this being combined with glycerine, though sometimes soft soap was added.

Notes on Varnish Removers

To remove shellac varnish apply the remover and when the varnish has become soft take hot water and

with sponge and soap powder wash it off. Use steel wool or steel wire brush for parts not easy to get at with the sponge.

Old varnish that contains rosin may easily be removed with alcohol, or benzol, or alkali. It may also be easy to remove by scraping or sandpapering.

Commercial removers cost several times as much as alkali, alcohol, or benzol, and in some instances the old varnish can be removed without remover, as when very old and dry, when it may be sandpapered off or scraped.

Don't use a remover that contains any fatty substance, for this would stick in moldings, cracks or carvings, or in the pores of woods, where a filler has not been used. In such a case varnish will not do well, and bleaching will be impossible.

Don't let the remover get down to the filler on hardwood, and to prevent this remove the old soft stuff as promptly as possible and wash off with rag and alcohol. Should the remover, however, get at the filler, better apply more remover to it and remove the filler and refill.

Should you grow dizzy or have any peculiar feeling while using a remover, get into fresh air as soon as possible, and do not resume the work unless plenty of fresh air is possible. Watch for the symptoms of remover-poisoning; dizziness and nausea often occur, sometimes there is a pricking sensation, the eyes smart, and no time should be lost in getting away from the poisonous vapors. Blindness has often followed working with wood alcohol. If you will work at it, then every few minutes get a whiff at least of outdoor air.

PRACTICAL NOTES ON VARNISHING

THE expression, "Drying from the bottom up," or "from the top," means the difference between the surface drying of boiled linseed oil and the more uniform drying of raw linseed oil containing driers. Taken literally, the statement is not exactly correct, because oxidation or drying must occur at the surface of the varnish or the oil, and not at the bottom. But the term "drying from the bottom up" indicates a certain process that is different from the usual drying of varnish, oil, or paint that has driers added. Varnish, as well as the other substances given, dries by the absorption of oxygen from the outside, and raw oil, for example, will absorb oxygen more slowly than boiled oil, hence will become thicker slowly, and will become gummy before the surface dries. Take boiled oil and raw oil, side by side, and it will be found that the former will have skinned over before the latter oil will show any signs of doing so. Remove the skin from the boiled oil and you will find that under it the oil is as soft as ever.

TEMPERATURE OF VARNISHING ROOM.—Some rooms are heated up to 90 deg., but the heat seems to affect the woodwork. At a lower temperature some rooms normally heated to that high degree cause poor flowing of the varnish. Much depends upon the varnish and the wood. The varnish may be a rapid drier, suitable to a high temperature, or a slow drier, best adapted to a low temperature. If the wood is not perfectly dry it will be affected by extreme heat, which will result in shrinking. Hence, a low temperature is

best for wood that is not dry, and of course little ever is absolutely dry. Perfectly dry wood will not be affected by heat. Filling and rubbing and varnishing do best in a rather high temperature, yet not too high. Some finishers advise and use a temperature of 110 degrees.

Why Varnish Cracks.—Cracking of varnish arises from any one of several causes. Varnish to which has been added driers to harden it will crack, especially if exposed to a strong sunlight. The cracks will be very fine and close, having the appearance of silk. Later on these fine cracks may open out much wider. Such cracks are sharp and clear-cut, like the edge of a razor blade, and they criss-cross in all directions. If driers have been used in any of the under coats the fact will be indicated by the depth of the crack. Applying a hard, quick-drying varnish on a soft undercoat of varnish will generally cause cracking, which will, of course, affect the over-coating. The cracking may also be traced to the application of a glaze coat, applied prior to the varnishing, or to a gold size and turpentine flattening on an oil ground. Gold size cracks may be recognized by their tendency to follow the direction of the brush-work; they have softer and more rounded edges than those in the previous case. They are also less numerous and more open in character. The application of a size coat upon a hard, non-porous ground previous to varnishing, such as occurs in cheap work or in revarnishing, will sometimes be productive of cracks, especially if the size be strong. The cracks are usually polygon shaped, with edges curling outward.

Cloudy Shellac Varnish.—Shellac, a spirit varnish, will become turbid and spongy if the vessel containing it is not tightly sealed. The volatile spirits evaporate, leaving the water, which alcohol contains

in less or greater degree, and it is this water that causes the troubled look of the shellac. Withdraw the water by means of strips of gelatine, which will absorb it entirely. These strips may be dried and are as good as before. Then add alcohol to the shellac.

How to Varnish.—For three-coat work let the first coat become perfectly dry before applying the second. This will allow for the application of the third coat much sooner than would otherwise be the case, as the whole will dry out much quicker and be ready sooner for rubbing. Don't rush the second coat onto the first, and then give longer time between the second and third coats. If the first coat is not dry it will retard the drying of both succeeding coats. If the second coat is allowed to stand a long time it forms a hard surface to which the next coat will not stick well, and it will also sweat when rubbed, if rubbed too close. Give at least double the time between the second and first coats that is allowed between the second and third coats.

If only two coats are to be applied and it is your plan to rub close and fine it will be best to apply the second coat before the first becomes too dry to unite well; or a light coat may be applied first and be allowed to dry thoroughly and the second coat put on slightly heavier. For a careful rubber the latter method is best.

Varnish Turns Green.—The turning of a varnish finish green may be due to several causes. This discoloration is a bottle green. One cause is the use of a poor shellac, or one the solvent of which contains water. Application of shellac in humid weather; orange shellac will turn green, and bleached shellac is more likely to turn gray. The trouble may come from the stain used on the work. When a stain shows a greenish cast after being varnished over it is usually

more pronounced when a pigment or varnish surfacer has been used, or when the varnish is applied directly over the stain or filler. Also the trouble may be caused by the glue or some acids coming through the veneer, upon which the stain acts. Some think the varnish was too fresh or had not age enough.

Of course there are other causes for this unsightly appearance in the finish on mahogany besides moisture in the shellac. It may be caused by a surfacer made from a poor grade of varnish or a surfacer containing too much pigment. A pigment surfacer should never be used on mahogany. If the pigment in the surfacer is a finely-ground and well-bolted high-grade silex, and is mixed in the right proportion with a good grade of varnish (not more than one pound of silex to one quart of varnish), it may safely be used on walnut. Only the best grade of shellac dissolved in alcohol, or methylated alcohol, should be used as a priming coat on mahogany, and then only a very thin coat should be applied. Some finishers do not use a primer on mahogany, but apply the varnish to the bare wood. But I prefer a priming coat of shellac, as it makes a better surface and results in smoother varnish. Bone-dry, bleached shellac is the best for this work, and should be of such a quality that it dissolves easily and thoroughly in the solvent. If the gum contains a percentage which is insoluble the whole lot should be discarded, as it would not be safe to use it on mahogany, as it is almost certain to show up gray in time.

There is one other cause of this green hue to mahogany which we might mention, and that is an inferior quality of stain. No matter whether it is an oil or water stain, the coloring matter should be thoroughly dissolved. If this coloring matter is merely held in suspension in the solvent instead of in solution, a very poor quality of work will be the result. One should be

on the lookout for things of this kind at all times. Strain the stain through cheese-cloth or book muslin, and if a considerable residue is found the stain had better be abandoned. There are stains which will produce good results, and these are the ones to use on mahogany.

Heavy Bodied Varnish.—There is a demand for a heavy bodied varnish, but the varnish maker hesitates to supply this demand because such a varnish is sure to give trouble. This varnish is not bodied up with high-grade gums, because the price will not admit of it. It does not dry through like a medium bodied varnish. It is more likely to crack when dry.

Varnish Does Not Flow Freely.—Varnish that has been stored in a freezing atmosphere will not flow freely; it should be placed in a vessel of hot water before using. Varnish that has been exposed to the air for some time will not flow well; warm it and thin out a little with warm turpentine.

Difference between Exterior and Interior Varnish.—The principal difference is in the amount of oil contained in the varnishes. Exterior varnish contains the most oil. Spar, outside varnish, contains the best of varnish gums, Kauri. It is used in the best exterior and interior varnishes. Painters sometimes use a floor varnish for exterior work. Floor varnish, though made for inside work, contains more oil than other interior varnishes, hence is suitable for outside doors, etc.

Composition of Spar Varnish.—The best is made from 100 lbs. of Kauri gum with 36 gals. of oil. One-fourth of the varnish gums go up the chimney in the boiling process.

Composition of Interior Varnish.—Fifteen gallons of oil to the hundred pounds of Kauri gum. Some varnish makers use about eight gallons of oil to the

hundred of Kauri gum, but fifteen pounds of oil is a liberal allowance.

Composition of Floor Varnish.—Proportions vary with different varnish makers, as might be expected, but a very good grade is made upon the formula of 30 gals. of oil to the 100 lbs. of gum. Floor varnish needs to be rather elastic, hence the large amount of oil fitting it for exterior use also.

How Varnish Is Made.—A brief account of the manufacture of varnish has been given in another part of this work, but this furnishes some more details. The raw materials are gum, free oil, and thinners. The latter is either turpentine or benzine, or a mixture of both. The usual batch of gum for a melting is 100 lbs. This is put over a coke fire and heated until melted. As one-fourth of this gum escapes up the chimney, it leaves really only 75 lbs. of gum. The gum must be melted to exactly the right point, neither too much nor yet too little. Then some prepared oil is added to it. This is a specially prepared oil furnished by the oil crusher. It must be thoroughly clarified and all mucilaginous matter must be removed. Taking this prepared oil the varnish maker heats it up with litharge until the oil has dissolved a certain amount; this is then called "lead oil." He next adds some umber and boils it in this special oil and it dissolves manganese dioxide, and this makes "milk oil." It has drying properties. He then takes borate of manganese and adds this to the special oil and heats it up to a high temperature, and the oil dissolves the manganese borate, making "borate oil," which is a very pure oil. Now, depending on the treatment, he produces any different kind of properties he wishes the finished product to have. Now the gum is melted and in a liquid state. He adds a quantity of these oils to the melted gum liquid, which is then run back on to the fire and is

heated again to a certain temperature until gum and oil are thoroughly amalgamated; then the varnish is allowed to cool until it has reached a temperature where it is no longer dangerous from presence of fire and thinners. He adds the thinners, whatever they may be, and the varnish is then of the proper brush consistency.

Now the varnish must be filtered, then placed in storage tanks to remain according to the quality of the product, or the use it is intended to serve, usually from three to eighteen months. Varnish fresh from the making does not work free under the brush, age giving it easy-flowing qualities that all varnishers appreciate. The term "free oil" means oil that has been clarified by filtering and settling, in which condition it is nearly as clear as bleached oil.

China Wood Oil.—China wood oil, also known as nut oil, cannot be used in its raw state, but must be "treated." It is very tough, and more impervious to water than linseed oil; it would be especially useful in floor varnish. But China oil has not met the expectations of varnish makers and users, as it presents too many difficulties in its preparation for use with the usual varnish gums and linseed oil. Where it has been tried in varnish it has shown some wonderful properties, producing a varnish that high heat, as from a hot iron, boiling water, and alcohol, etc., has no effect upon. The writer has fully tested it in these respects.

DESCRIPTION OF VARNISHES USED

The making of oil varnishes is a very simple matter, looked at from one angle, as the substances used are few in number, and the process of turning these substances into a viscous fluid about as simple as negotiating a pot of soup. Yet it is far more serious than this. The proper making of varnish requires the services of an expert workman, and the guidance of a trained chemist. It is quite possible for a workman used to handling varnishes to produce a pot of oil varnish; in fact, at one time much of the varnishes used in the shop was home-made. And at another not very remote period the varnish maker traveled from shop to shop and made the varnish on the spot to fill any order received. The varnish thus turned out was good and well suited for the purpose intended. But to-day there are so many uses for varnishes, so many diverse uses, that it requires the chemist, as stated, and the expert workman and varnish factory to produce the different kinds of varnish required. Briefly, the varnish gums are melted in large copper kettles, and when melted the requisite quantity of linseed oil, which has been heated to the same degree as the gums, is added. The gums and oil readily unite, but to make sure the boiling is continued for some time longer; this is to insure a perfect union of the gums and oil, so that they will not separate afterwards. Then the mass is allowed to cool down, after which it is thinned. The thinner may be either turpentine or benzine, depending on the grade. If turpentine is used the varnish should not be permitted to get much below 300

deg. Fahr. With benzine it may be allowed to get much lower, owing to the very volatile nature of the benzine.

If the varnish is not cooked enough it will work freely under the brush, but it will not hold luster nor wear well.

In making a pale varnish bleached linseed oil or poppyseed oil is used. Such oils are prepared by boiling for a certain length of time with one or more of the various salts of the heavy metals, such as lead or manganese, or both in combination, the same being added to the melted gum. When the oil and gum have become thoroughly mixed and have obtained the required consistency the solvents are added, after which the liquid mass is filtered and stored in settling tanks.

A varnish carrying 100 lbs. of kauri gum and 25 gals. of oil will require from 25 to 35 gals. of turpentine as a thinner; the gum will bulk 5 to 9 pounds to the gallon, according to loss in melting or fusing. The loss in thinning may be estimated at 10 per cent. This, with the loss in varnish bottoms or settlings, in kettle and tank, would result in a product of about 60 gallons of salable varnish, providing 30 gallons of turpentine have been used for thinning.

Short and Long Oil Varnish.—Short-oil varnish is one that contains from 5 to 15 gallons of oil. Long-oil varnish contains from 20 to 40 gallons of oil, both to the 100 lbs. of gum. Furniture varnish, hard oil finish, and cabinet varnishes are made on the short-oil basis. Rubbing varnish, polishing, architectural and interior varnishes are made on the long-oil basis. Piano varnish contains very little oil, hence is too hard for ordinary use; it dries very hard and takes a high polish. For interior work subject to much handling and where a brilliant gloss is desired, a hard gum

short-oil varnish should be used. Varnish intended to withstand water or moisture must contain enough gum to keep the oil from turning white. Railway, carriage body, coach and implement, and other durable varnishes, usually contain an excess of oil. For furniture not subject to rough usage a rosin short-oil varnish will do, but articles receiving hard use will need a varnish rather long in oil.

As a rule the varnish long in oil will wear better than a short-oil varnish, but its luster will not be as good. A long-oil varnish dries slowly, hardens more thoroughly than a short-oil varnish, and retains its elasticity better.

Some Varnish Notes.—There is no essential difference between coach and cabinet varnishes, they being practically identical in manufacture and materials; it may be added, however, that, if anything, the former are made from a better grade of materials and more care is taken in the making. It is not unusual to take several brands of cabinet and coach varnish out of one tank.

Cheaper grades of varnish usually contain Manila copal and rosin. By treating rosin in a certain way, usually by means of lime, zinc salts, etc., the rosin is hardened and made tougher, and such gum, dissolved in a mixture of linseed oil and wood oil, gives a very durable varnish, though not one equal to kauri gum varnish.

The best varnish, viewed from any standpoint, is that made from good copal gum, and of which gum there are many varieties.

Copal varnish varies from a light amber to a dark rich brown, chiefly depending on the condition of the gum. As good a varnish can be made from a dark copal gum as from a paler sort; color does not influ-

ence quality. If anything, the darker gum is the better, because a harder gum.

Sandarach varnish is used for varnishing the sounding boards of pianos. The most brilliant varnish is produced from gum mastic; the hardest from gum sandarach, and the toughest from shellac, which is also a very hard varnish.

Aged vs. New Varnish.—Old varnish wears better than new, but on cheap work the new varnish is advised, as it will cost less, owing to one fact at least—it has not been stored to age or settle, and which adds to the cost of getting out a varnish. True, you may pay for old varnish and not get it. There is no easy way for the buyer to determine whether the varnish is old or new, so it is well to do the storing yourself if you want to make sure of age and settling of the foots in the oil. Buy it in drum or barrel, and draw it off as needed and without disturbing the settlings.

Effects of Temperature.—Keep your varnish stock in an even temperature, ranging from 65 deg. to 75 deg. The degree of humidity should be low. The temperature of the varnishing room should be about 75 deg. This temperature makes the working of the varnish easy, and induces drying that will be more uniform, drying more from the bottom up, rather than from the top down. A high degree of heat has the effect of drying the surface of the varnish at once, and this prevents the under portion from drying as quickly as it otherwise would. Too high a temperature—some advise as high as 110 deg.—will cause the undry varnish to flow out and form sags or curtains on work standing in a vertical position.

Never allow the varnish to become chilled either in can or on the work. In cold weather it is advisable to do the varnishing in the forenoon or midday, when

the sun is at its best, and by which the work will have longer to dry in a better heat than usually prevails during the night. But the shop or finishing room, or room where the varnished work stands, should be warm night as well as day.

Characteristics of Good Varnish.—It should remain brilliant after the evaporation of the liquid medium and present a hard, dry surface, instead of a soft or tarnished surface. It should adhere closely to the surface of the article coated with it, and not scale when it becomes dry, even after a long time. Linseed oil varnish should be clear and show no turbidity or have any solid bodies in suspension. Leaving it at rest two weeks in a moderately warm place should clarify it; but if it contains rosin oil it will not do so. A very slight amount of sediment may be looked for in the best of varnish, less than one-fourth of one per cent. after standing several months; inferior varnish will often show as much as seven per cent., it being imperfectly clarified.

Heat-Resisting Varnishes.—Varnish designed to stand a high degree of heat is made from a gum that melts or discolors at a higher temperature than that which the varnish is subject to; baking varnish is such a one. Asphaltum is soft, yet it stands a very high degree of heat and is useful for coating automobile parts and other articles. The high heat of the baking oven causes it to become very hard and lustrous.

How Many Coats of Varnish?—As a general thing too many coats of varnish tends to cracking, owing to uneven drying; if each coat is dried thoroughly before the succeeding one the cracking would be less if not entirely absent. But we must take the matter as it is—varnish is hardly ever given sufficient time to dry right. An old shop rule runs thus:

One coat of varnish never cracks,
Two coats seldom crack,
Three coats often crack,
Four coats always crack.

Like all other rules, this one has exceptions. The character of the work, whether cheap or high class, will determine the number of coats that are to be given. Also the time allowance for the drying of each coat. It is true that a large number of coats may be given without failure of the job to stand well. If the coats are all of the same varnish cracking is less likely to occur than when different varnishes are used.

Varnishes differ in many ways; some require as much as seven days to dry, while others will dry inside of ten or twelve hours. Most of our varnish troubles come from insufficient time allowance for drying. A varnish is made for a certain kind of work and is made to fit any quality of work, by means of the price. Interior varnish should not be used on exterior work, nor exterior varnish on interior work, as a general thing at least. Rubbing varnish will not take the place of polishing varnish. The varnish that is made for agricultural implement and wagon work will not do for carriage or coach work. And so on.

The high-pressure rate at which work is turned out in many shops, and the inferior varnishes, etc., addition of driers, etc., all incidental to hurry-work, causes lots of trouble. Then the work may not be in proper condition for the varnish; it may be undry, dirty, dusty, even greasy. The room may be too cold at night, causing the varnish to creep. Maybe the varnish has had a chill after the varnished article has been placed in the drying room, which was too cold. Chilling causes an uneven flow of the varnish. The can of varnish, if shaken up, may cause pitting. When

varnish is thus shaken up it is liable to absorb some air, which before was on the top of the varnish; this is why some workmen let the open can of varnish stand exposed for a little while after it has been shaken up in the handling. It allows the air or gas to escape. Then careless work in the application of varnish, as when it is too heavy, the drying being retarded and crimping, a sort of ridgy appearance, resulting. Or thinning the varnish, injuring its gloss. Thinning is often done to make the varnish flow easier.

Some varnish will dry on the surface, giving the impression that it is dry clear through. If then another coat is applied there will be varnish trouble; allow varnish at least two days for drying before rubbing or applying another coat. Varnishing in a cold or damp room will be apt to cause varnish trouble. Flowing varnish, having much elasticity, due to its oil content, is the most injured by thinning. In fine cabinet finishing it is sometimes the practice to reduce the first coat of varnish a great deal, using turpentine, so that it will penetrate the wood better, act as binder, seal the pores of the wood, and thus make a good foundation for the succeeding coats. After that coat the varnish is used straight, no thinning, and ample time is allowed for drying and hardening. If it appears necessary to thin the varnish, first warm the turpentine and varnish, in separate vessels, then add the turpentine gradually, shaking the varnish now and then, which will cause perfect amalgamation in the end and much better than when the thinning is done in the cold state. Varnish should never be thinned on the last coat. If the varnish or room is cold, you do not need more thinners, but more heat.

Another trouble to be apprehended from using turpentine for thinning is that it may not be straight spirits; some alleged turpentine will be found to con-

tain as high as fifty per cent. of adulteration, usually petroleum oil. Such a turpentine will cause the varnish to be sticky when dry. Benzine would be safer, for it could not injure the varnish and would evaporate quickly and entirely and not injure the gloss of the varnish as turpentine will.

Varnish is a delicate liquid to manipulate, or at least the better grades are, for the finer the varnish the more delicate it is, and the more careful should one be in its handling.

To give the best results varnish must have ventilation and fresh air for drying. The temperature must be right, 73 deg. at least. If, after all has been done right and the varnish does not do right, better interview its maker, for he may be able to explain its action. If you find a lot of sediment at the bottom of a barrel of varnish it indicates that its maker did not filter the goods, as should be done in the case of high-grade goods. A varnish properly made, allowed to settle, and placed in clean containers, must, of course, come forth bright and clean, allowing the worker a chance to do clean work.

Flatting Varnish.—The object with the use of flatting varnish is to simulate the appearance of rubbed varnish. Like any other imitation, it is inferior to the original. Here are a few of the several formulas used in its preparation.

1. Dissolve four ounces of shredded wax in one quart of turpentine, which may be cold or hot, the wax melting sooner in the hot turpentine than in the cold. In another vessel place one gallon of hard drying copal varnish or quick-drying rubbing varnish, and place this vessel in another containing hot water, and place on back of stove. When both are heated sufficiently they may be mixed together and be well shaken. After about two days the varnish will be ready for use. It is

very important that the wax and varnish be well mixed in order to get good working and wearing results.

2. Heat on back of stove or on hot water bath one gallon of hard oil finish; shred fine six ounces of beeswax and add to the varnish; shake or stir the mass well. Then stir in two ounces of sweet oil, following this with three pints of turpentine; this will make about two gallons of flatting varnish. While still warm filter or strain through cheese-cloth into varnish cans, leaving the cans open until the varnish becomes cool. The sweet oil is intended to retard the setting of the varnish, which may prove too rapid for spreading unless thus treated. Some workmen object to the addition of the sweet oil, and in this case there may be added a tablespoonful of gold size japan to the gallon of varnish, if it is hard oil varnish; or twice as much in the case of exterior varnish. This will counter the effects of the sweet oil, which some think makes the varnish too soft.

3. This is a factory formula. It is included here merely to show how it is prepared commercially, with no intention of having the wood-finisher prepare it this way. Saponify ten gallons of China wood oil by boiling in an ordinary varnish kettle with eleven gallons of water, in which is dissolved eight pounds of sal soda and one pound of granulated caustic soda. In another vessel dissolve twenty pounds of alum in twenty pounds of water, to be used later on. When the oil shows complete saponification and drops heavily from the stirrer add twenty-two pounds of pale rosin, pulverized, so that it will melt quicker. As soon as the rosin is melted and thoroughly incorporated with the soap, add the alum solution, which will cause the mass to separate upon stirring. Let the mass stand over night, then pour off all the water possible, or

siphon off with a hose. Place kettle again on the fire and drive off remainder of water by heat. Then dissolve residue in seventy gallons of turpentine. Mix equal parts by measure of this dilute soap and any Manila or Kauri gum you may wish to dry flat. Rubbing varnish is most easily flatted, while a slow-drying coach or exterior varnish will not suit the purpose.

You will note that in this factory formula no wax is used to flat the varnish. There are other substances that may be used in making flatting varnish, such as China clay and glue. Japan wax may be used. Glue is cheaper than beeswax. Or the dull effect may be produced by means of an alkali, which is used, as you will note by the foregoing formula. But alkali produces an emulsion inimical to good wearing. Some add kerosene oil to varnish, saying that it gives the flat or dull effect and a very uniform surface, but it is probable that such a varnish would not give satisfaction. Some add raw linseed oil to real wax flatting varnish instead of sweet oil, two ounces of the oil to the gallon of varnish. The linseed oil serves as a binder, assists the spreading of the varnish, making it flow better and leaving no brush marks or laps. But there is danger of the linseed oil and wax separating instead of binding, whereas no such objection has been urged against sweet oil.

Flatting varnish should be made and used thin, for this will insure free flow and even surface. Be careful in any case against laps. Use a badger hair brush and lay the work off one way, feathering it the opposite way; work the brush rapidly, as the varnish sets quickly. Get a smooth, uniform surface, for a streaked, ropy job looks very bad and cannot be amended except by removal. Real wax flatting will be found more difficult to work, owing to the wax,

than the factory article. If too much wax is added the varnish will be too soft; it is well to try the surface to ascertain how hard it is before you go too far.

New work may be filled in the usual manner, shellacked, and be coated with two coats of flatting varnish. Use clean pots and brushes; finish parts at a time and so avoid laps.

Flatting varnish is said to have originated with car finishers, who wanted to save time in producing a flat effect on inside of cars. It is not a durable finish; where there are turned parts, balusters, etc., difficult to rub, where the job is one of hand-rubbed work, flat varnish does very well.

Practical Varnish Notes

Allow a coating of varnish ample time for drying.

Use that varnish that was intended for the work you have in hand.

Never wet the brush with oil or turpentine while varnishing.

The less varnish is worked under the brush the better will be its luster.

If the brush is too small for the work, or if you work the varnish too long, you will likely have brush-marks.

Thin varnish does not bear out well; if too heavy it will not spread and level up smoothly.

Light-bodied varnish will flow out easily and not show brush-marks as heavy-bodied varnish often does.

Heavy-bodied varnish should not be brushed out much, but be flowed on full, so that it will level-up itself.

Use clean overalls, as well as clean brushes, clean pot and clean varnish. Before starting the job see that the surface is clean.

Often a varnished surface, some hours after varnishing, appears quite dry, and it is, but the surface only, with the under part soft.

Better use a paler varnish rather than thin a dark one down to make it look paler on the work.

VARNISH ILLS—CAUSE AND CURE

Blistering.—Caused by oil or moisture under the varnish coat, or by heat acting on undry wood. Or using an elastic varnish over shellac as a first-coater; if the heat or rays of the sun fall directly on the work the shellac will soften and the varnish will blister. Remedy, removal of the varnish.

Blooming.—Too much driers, or varnish too new, or adulterated oil under the varnish, or undercoat not dry, or dampness affecting the undry varnish. Ammonia fumes in the air, also frost, will cause blooming. Cure: Rub surface with waste, dipped in water, then in crude oil. Gas causes it. A bluish film overspreads the varnish; the finest varnishes are most liable to bloom.

Brush Marks.—Usually caused by working the brush too much when applying varnish; sometimes heavy varnish will do it if workman is not careful. A brush too small for the area being done will sometimes cause brush marks.

Blotching.—An aggravated form of pinholing. Caused by oily or damp surface; or turpentine-thinned varnish; or improper thinning fluid. Bad cases also known as pitting and pocking.

Bubbling.—When the varnish is too warm little air bubbles form under the brushing; not serious, simply cool the varnish.

Brittleness.—Cheap varnish usually contains rosin, a brittle substance, together with benzine, with a very little oil; hence a brittle varnish, producing a finish that easily chips.

CHILLING.—Varnish will chill in cold weather unless kept in a warm place, and the same with the applied varnish, which will show a sandy or gritty surface. The grit is simply particles of gum; heat the varnish and these particles unite again with the oil, either in the can or on the varnished surface. A good way to heat the varnish in the can is to set it on two heated bricks, or on back of stove, with stopper out. Then set it away in a warm place. It injures varnish to become very cold. Heat does no injury.

CRIMPING.—Same as Wrinkling and Crinkling. Causes, too heavy a varnish, exposure to sudden change of temperature, and application of the finishing coat before the under coat is dry.

CREEPING OR CRAWLING.—The varnish does not lie where placed, but creeps up in little patches. Worse in cold weather in the absence of heat. Also on old glossy varnished surfaces. Remedy, wet the parts with vinegar or benzine, or even rubbing with a rag wet with clear water. Sometimes caused by greasy or oily surface. In this case rub with benzine. Vinegar also good.

CHIPPING.—Enameling most affected. Caused by lack of harmony between the different coats of varnish used, they not uniting perfectly. Or brittle coating under. Or undry undercoating, or exposure to cold during drying, or poor ventilation, varnishing in a cold room, or in a room with a damp floor.

CHECKING.—Caused by fumes of ammonia, coal gas, washing with hot water, or exposure to sudden and violent changes of temperature while drying. Sometimes called Crumbling.

SILKING.—In its mildest form known as enameling. Appearance of silked varnish similar to silk cloth, hence its name. Cause may be working in a cold room, or application of varnish to a very cold surface, or

exposure to cold draft of air while drying, or undry undercoats, or mixing turpentine with the varnish in the cold.

Sinking In.—Or assuming a dead appearance. Is due to various causes. If the foundation on open-grained wood is imperfect the varnish will sink into the pores, which should have been well filled. The finer the varnish the more likely it is to sink in on a poor foundation. Another cause is found in the thinning of the varnish from start to finish. Other causes are applying varnish over an undry coat, badly seasoned wood, using varnish from a newly opened can.

Sweating.—When gloss appears after the rubbing it is called sweating. Causes, rubbing the varnish before it is dry and hard all through; to cure, let the coating become hard, then rub again, and apply the next coat. Long-oil varnish is the most apt to sweat because it contains considerable oil, making it slow in drying hard. In case the rubbed varnish that sweated is one that never does dry hard better apply a coat of hard varnish, and then rub again.

Seedy Varnish.—See Chilling.

Sandy Appearance.—The varnished surface looks as if sand had been cast over it; it is an aggravated case of chilling. Caused by unripe varnish, chilling of varnish by extreme cold weather, skinning over of varnish before it is used, dirt or pumicestone grit, granular particles from varnish brush, chemical change in varnish due to old age, and precipitation of the gum by extreme cold.

Sagging.—The varnish has been applied too freely or the coating is too heavy, resulting in the formation of "curtains" or "festoons," as they are called.

Sissing or Cissing.—Same as Crawling, which see.

Tears.—Small but heavy runs, usually about the moldings, etc. Cause, uneven application of varnish.

Turning White.—Due to heat or moisture or both on varnish containing rosin. Any varnish, however, that is applied over liquid filler will turn white if water stands on it a little while, due to the moisture penetrating the coating down to the filler, which will then turn white and show through the upper coating as white; moreover, it will scratch white. It may take two or three hours for the water to get down to the filler, but if left on long enough it will get there. Liquid filler and shellac are alike in the matter of sealing the pores of the wood, while the coat of varnish simply remains on top and does not penetrate through into the wood.

Wrinkling.—Same as Crimping and Crinkling.

Pitting or Pinholing.—Shows little pockmarks, caused by changes of temperature, or draft striking the varnish while it is drying. Applying varnish over cold or insufficiently dry undercoat, or over a glossy surface without sandpapering it. Mostly result of poor filling. On close-grained wood where no filler has been used if the first coat of varnish has not been thinned properly it does not penetrate the wood as it should; result, lots of tiny so-called pinholes.

Flatting.—Deadening of the finish coat, caused by undry undercoat. Also to poor filling on unseasoned lumber. See also Sinking In.

Loss of Brilliancy.—This is thought by some to be due to an improperly cooked varnish, but this is not always if ever so. As we have already pointed out, loss of luster or deadening of a varnish is mostly due to poor foundation, the oil and gum sink in, leaving only a very thin coating on the surface. A linseed oil varnish containing some China wood oil stands out on a poor foundation better than the varnish containing only the linseed oil and turpentine.

Skinning Over of Varnish.—If oil varnish is

left exposed to the air a skin forms over it, and unless this skin is removed by straining it will cause a specky appearance of the varnish coating. Better strain such varnish through cheese-cloth before using. Exposure to the air for some time causes oxidation of the varnish, making it "fatty," in which condition it is not fit for use.

SHELLAC VARNISH

Lac is a resinous incrustation excreted by a scale insect known as *Tachardia lacca.* The mouth parts of this insect consist of a beak or sucking apparatus combined with a pointed lancet. With this lancet the insect pierces the bark of the twig of a tree, and then inserts a sucking tube and draws up the sap. The insect may be likened to an animated siphon, since the sap, continually sucked up through the beak, is, after modification and absorption of some of its products, given out as an excretion at the anal end of the body. This secretion solidifies in contact with the air, and thus there is gradually formed around the body a scale or cell, known as lac. Were only one insect present on a branch the scale would appear as a circular, dome-shaped, reddish excrescence on the surface of the bark. Owing, however, to the production by the female of a very large number of eggs, often as many as one thousand, and the habit of the insects, which is indeed common to many of the family, of living and feeding gregariously, closely packed together on one twig, the scales or cells coalesce during their formation and result in the continuous incrustation on the twigs, which on collection forms the article of commerce known as stick-lac.

From stick-lac we get the familiar "shellac" or shell-lac. There is also button-lac, plate-lac, and seed-lac, all in different forms, and from which each gets its name.

Natives of India, where the lac is found, strip the trees of the heavily coated twigs and limbs and place

them in hot water, which soon dissolves the resinous matter, freeing insects and bits of wood and also washing out the coloring matter deposited by the insects. The separated lac is then taken out and dried, and later on is placed in strong coarse cotton bags. These bags are then held near a fire which, while melting the resin, does not scorch the muslin. The bags are then squeezed and twisted. This treatment forces out the resin in a thin film, which is received upon strips of wood, where the resin quickly hardens, when the lac is easily broken off in the form of thin pieces, something like thin gelatin or glue, the form being well known to shellac users.

The best grade of shellac is that which is freest from all impurities. As these impurities are dark it follows that the best shellac is of the lightest color; it is a light orange or brownish cast. When they are squeezing the bag some of the lac falls to the ground, in which case it takes on the form of a drop or button, hence its name, button-lac. If these buttons spread out large they become plate-lac. Stick-lac is the resin still on the twigs, which have been broken for convenience in carrying. Under the lac trees are found quantities of lac that has been forced from the tree by wind or other means, and all this is carefully gathered up by the natives and sold as seed-lac. Shellac is superior to the rest because the best prepared.

Pure shellac is simply a combination of several peculiar resins combined and mixed together as only the little lac insect can do it. This lac is important because of its adaptability for making varnish. Lac is easy of dissolution. In alcohol or alkaline solution, borax being the usual alkali used, lac gives a fine, hard varnish, capable of taking a depth and brilliancy of polish unexcelled by any other resin or manufactured varnish.

Adulteration of Shellac.—It is easy enough to get pure orange shellac from any reputable dealer, but white shellac is very liable to be adulterated because it is very easy to do it. This is done in the bleaching process; it is more than likely to contain some water and some substance to add to its weight and make it whiter.

Where orange shellac is adulterated the precipitation and drying differ from the action of the pure gum. If rosin is present the alcohol will hold it in solution and precipitate the shellac, the shellac being the hardest of the two to dissolve. Few substances will dissolve shellac. Rosin causes shellac varnish to dry soft. A finisher can apply two coats of pure shellac varnish in one day, and rub down each coat and get good results. But rosin shellac will remain tacky for hours, so that not more than one coat can be rubbed in a day. But note here that one coat of pure shellac varnish is all that should be applied in one day if the best work is desired. As many as three coats of pure shellac varnish may be applied in one day and be rubbed down, but this is not advised. An expert finisher says: "A pure shellac varnish should be fit to handle in six minutes after application, and be fit to sandpaper in thirty, without gumming the sandpaper. The second coat should dry in seven minutes, having been applied within thirty minutes after the first coat. In two hours apply the third coat, which should be hard to the touch in ten minutes. In one hour after applying the third coat it should be fit to rub down with oil and pumice-stone." To all of which we object as being too fast for durability.

Bleached White Shellac.—The orange-colored shellac can be treated to eliminate the color and produce a colorless or white gum shellac. This can be done in various ways, one way being as follows: Boil

the orange shellac in a weak solution of carbonate of potash, and when dissolution is effected collect the shellac, melt it under water, and while it is soft pull it until it has a satiny appearance.

Another way is to boil the shellac in a weak solution of potash, and while it is in a melted state pull and work it until white enough. Then remelt it and pull again in clean warm water. The two methods given are for small quantities, by hand work. On a commercial scale the process is more tedious, requiring at least twelve operations, as follows:

Crushing the raw shellac to a powder, so that it will be more readily soluble in the alkaline solution; separation of the coloring principle from the resin; preparation of the bleaching agent, or hypochlorite of potash or soda; treatment of the liquefied shellac by the bleaching agent; diluting the bleached shellac alkaline solution in water; preparing the sulphuric acid for neutralizing the shellac alkaline solution of shellac; neutralizing the shellac alkaline solution by the use of dilute sulphuric acid, which coincidentally precipitates the bleached shellac; filtering the precipitate or pulp of the bleached shellac to develop whiteness and elasticity; hardening and whitening process of the sulphurous acid bath, which prevents to a very great extent the white shellac turning yellow when exposed to the light; drying the bleached shellac; and crushing the bleached shellac.

Here is a shop method: Dissolve one pound of orange shellac in two pounds of strong alcohol and leave it in a warm place for a few days. Then prepare a mixture of one pound of 20 per cent. bleaching powder with three pounds of water, filter through a linen cloth, and wash the residue with one-half pound of water, the two waters being united and mixed with 33 per cent. aqueous solution of potash until no fur-

ther precipitate is formed, four and one-half ounces of potash being usually enough per pound of bleach. The filtrate from this treatment is stirred into the warm solution of shellac, and at the end of thirty minutes sufficient hydrochloric acid to produce a decided acid reaction, whereupon the shellac will be deposited as a perfectly white mass, which is removed from the liquid and washed with boiling water until the washings cease to run off milky. The shellac is then molded into strips, which are dried in the sun and open air. The acid liquor being neutralized with quicklime can be distilled to recover the alcohol.

Bleached shellac comes in granular form for easy "cutting" or dissolution in alcohol; it is more difficult to cut than orange shellac. Some samples show more difficulty than others, all depending upon the care used in the bleaching, for if any lime is left through scant washing it will be harder for the alcohol to act upon the shellac. It is advised to place such shellac in clear warm water, to draw out the lime, after which the shellac may be thoroughly dried. This is worth trying. When the gum is placed in the alcohol for making the varnish the mass had better be placed on a hot water bath, which will facilitate the process, shaking it occasionally. Add two pounds of the gum to one gallon of alcohol and strain carefully after the gum has dissolved; some of it may not dissolve, and it is this that must be strained out. Keep the shellac in a non-metallic vessel, tightly stoppered.

Contact with metal darkens shellac, and this discoloration may be removed by the addition of a very little oxalic acid. It is said that the addition of a little oxalic acid to the white varnish at the time it is being dissolved in alcohol will prevent the discoloration.

White shellac is apt to deteriorate with age, and when it does the fact may be attributed to its improper

preparation; in this condition it is stringy and does not readily dissolve in alcohol. White shellac gum on hand for a long time may as well be discarded.

In the preparation of bleached shellac it is very important that every vestige of lime (chloride) be washed out, or that the acid be strong enough to neutralize the lime. The granulated form of white shellac is particularly liable to work badly, hence it is best to buy it in hanks, keeping these under water, changing the water frequently and skimming off the scum from time to time. Or the hanks may be kept in a crate or barrel with water at the bottom, covered over with burlap or other suitable material. When wanted for use the shellac must be thoroughly dried and every vestige of water removed.

Shellac is refined in the following manner: In a suitable boiler one and one-half parts of soda are dissolved with forty-five parts of water; to this is added in gradual portions as it dissolves five parts of gum shellac. This gives a violet-red color, with more or less traces of fatty substances. After complete solution the mixture is boiled for a few minutes, and the boiler is then covered with a wooden top, which is cemented down. The contents of the boiler are cooled slowly, and the grease on the surface of the solution is skimmed off, the shellac is precipitated with sulphuric acid, drop by drop, and well washed with water until all acid reaction is removed. The shellac is then put in boiling water and softened so that it may be worked into plaits or rods, and it is hardened by placing it in cold water containing some glycerine. The refined shellac should have a silvery to yellowish-white fracture. It should be perfectly dry, and soluble in alcohol.

When overtreated with chloride of lime white shellac is partly insoluble in alcohol, as has been pointed out.

Formerly no treatment for its restoration was known, but it has been discovered that if such shellac is first moistened with one-twentieth of its weight of ether and allowed to swell in a close vessel its solubility in alcohol will be restored.

The stronger the alcohol the better its cutting power. Sometimes it is well to pour off the first alcohol after it has been on the gum a while and replace it with fresh alcohol.

Sometimes white shellac will show a decided acid reaction, due to insufficient washing of the bulk shellac after its precipitation by sulphuric acid. Such a shellac is always difficult to dissolve. To neutralize the acidity add two ounces of caustic soda to one pint of boiling water, adding this to ten gallons of the shellac varnish. This will correct the acidity and make the shellac very soluble in alcohol.

The affinity of alcohol for water is so great that if only a very little water is added to a solution of alcohol shellac the water will combine with the alcohol, while part of the shellac will precipitate or separate from the solution. It is for this reason that the nearer "absolute" the alcohol is the better it will dissolve shellac gum, white or orange. The alcohol should be at least 95 per cent. strength. The least particle of water in it will result in the precipitation of more or less gum.

Orange Shellac.—Like the white variety, orange shellac should dissolve in alcohol without residue—this whether wood, grain, or denatured alcohol is used. A great deal depends upon the method employed in making the shellac, on the presence or absence of rosin, of which more further on. As to orange shellac, given the same degree of strength of solvent, there will always be a uniform result in the varnish making. Experiments have shown that with the best grade of alcohol there is no difference in the dissolving power

of wood, grain, or denatured alcohol. There is a difference in behavior of grain and wood alcohol on crude lac. Whereas grain alcohol dissolves both the lac and the coloring matter associated with it, the wood alcohol dissolves only the lac. By treating one hundred pounds of crude lac with methyl (wood) alcohol in an extraction apparatus similar to that of Soxhlett, a chemist (Singh) was able in the course of two or three hours to extract a product which is said to be equal to the best on the market. He suggested that the lac be placed on the market in the form of a coarse powder, instead of the shell form, and thus do away with the necessity of stretching the lac while in the plastic state, with the object of eliminating the rosin which is added at this stage to facilitate the manipulation. The addition of rosin to shellac is carried on so systematically, and the different brands are so well known, that a change is scarcely likely.

Concerning the use of wood and grain alcohol in shellac, while both have equal power in dissolving the shellac gum, yet there is a difference in the working qualities of the two. Grain alcohol works freer under the brush, sets reasonably slow, and dries hard. Wood alcohol sets so quickly as to make it difficult to brush out; it cannot be used in French polishing because it "drags" so badly. Although it sets quickly it hardens slower than grain alcohol shellac. Denatured alcohol contains ten per cent. of wood alcohol, and to that extent at least is inferior to pure grain alcohol. Some denatured alcohol contains mineral oil, benzine or kerosene, rendering it unfit for either dissolving or thinning shellac. Sometimes shellac varnish will be found to contain turpentine. In any case the denatured alcohol containing any of these liquids will, when mixed with an equal amount of water, give a milk-white liquid.

But when alcohol has been denatured with wood alcohol alone no such effect is produced.

Preparing Shellac Varnish.—An authority states that about four-fifths of the shellac made in this country is made by dissolving shellac, either white or orange, in a barrel suspended on a center and revolved at a speed of about fifty revolutions a minute. The resultant varnish is rather thin, having a tendency to settle. A good bodied shellac may be made by adding twenty-four ounces of the best orange shellac, say, D. C. or V. S. O., to the gallon of 95 per cent. alcohol. With brown button-lac, which is heavier and contains impurities, it will take two pounds to make a varnish equal in body to the former. To make a white shellac varnish add two pounds of white shellac to three quarts of 95 per cent. alcohol; this gives a good bodied varnish, using grain shellac. These varnishes may, of course, be reduced for use.

For shop use add as much as four pounds of shellac to the gallon of alcohol, or as much as the alcohol will cut, and then it may be thinned as used. It should be kept in a warm place in cold weather.

If it becomes too thick from evaporation, or has deteriorated from having stopper off, in which case moisture from the air will have weakened the alcohol, try adding a little turpentine to it and shaking it well.

On the commercial scale shellac is usually cut in the proportion of three, four and five pounds of lac to the gallon of alcohol, while an extra heavy shellac varnish is made by using six and three-quarter pounds of lac to the gallon. Use 95 per cent. alcohol. As one gallon of 95 per cent. alcohol weighs 7.75 to 7.80 pounds per gallon, the solution will contain about 50 per cent. of shellac by weight.

Artificial Shellac.—Many furniture makers use

shellac over paste filling, thus saving one coat of varnish, while the shellac stops suction that may exist from the failure of the filler to do its work perfectly. At much less cost an artificial shellac may be used, one having good surfacing qualities and one that may be thinned with benzine or turpentine. There is an artificial kauri gum known as French kauri. Here is a factory formula: Orange lac 100 lbs.; Artificial kauri 50 lbs.; common rosin 50 lbs.; gum camphor 1 oz.; acetone 5 gals.; wood alcohol 30 gals.

The true color of orange shellac is hard to get in imitation brown or orange shellac, but one ounce of tincture of aurine, which is of mineral origin, will color a gallon of shellac substitute to the required true shellac color. Aurine will dissolve in either wood or grain alcohol. The ready-made artificial or substitute shellac may be bought; it is not readily made in the shop.

Considerable artificial shellac is used for dipping; there is also used a mixture of equal parts of genuine shellac and rosin, two and one-half pounds of each to the gallon of alcohol, wood or denatured. The rosin is pulverized. This gives a very dark shellac, and a lighter one may be made with white shellac and a paler rosin, such W W, or water white. Add more alcohol if thinner varnish is desired. Coloring is usually added to dipping shellacs.

An excellent imitation of orange shellac may be made from a combination of Manila gum, prepared rosin, and a substitute alcohol; this latter is made from a mixture of liquid ingredients, and the resultant product presents the aspects of a variety of lacquer, while disclosing some of the peculiar features of genuine orange shellac with regard to drying and rubbing properties. Alcohol forms a part of the liquid solvent. Manila dust, with or without rosin, is used in place

of shellac. Manila dust dissolves quickly at an ordinary temperature in alcohol, producing a quick-drying varnish, but while quite transparent it does not flow well, which, however, is characteristic of all spirit varnishes.

The liquid solvent mentioned is composed of four parts wood alcohol, two parts fusel oil, and one part benzol, the liquids being thoroughly mixed. In the mixture is placed a fractional part of aurine, which is dissolved under constant stirring. When the solution is complete it is allowed to settle and clarify before using. One ounce of aurine is sufficient for one gallon of imitation shellac varnish.

Here is another factory method of making the imitation shellac varnish. Manila dust 100 lbs.; prepared rosin 50 lbs.; wood alcohol 25 gals.; naphtha 5 gals.; acetone 3 gals. These substances are placed in a revolving petroleum barrel, the barrel turning for about four hours without cessation. By that time the solids will have dissolved, then a quart of tincture of aurine is added. The liquid will clarify some if allowed to stand some time before using.

The above formulas and methods are not intended for the shop, for the workman would find them impossible, the idea being to give him a clear understanding of the processes by which such goods are made. The descriptions are merely educational.

Here, however, is a shellac substitute that can be made in the shop very readily. Take four pounds of China clay or finely pulverized silica and stir into it one quart of good japan driers, beating the mass to a smooth paste. While stirring briskly add one and one-half gallons of the best hard-oil finish or similar grade of varnish, and then let the mass stand an hour or so; finally strain through a fine sieve; thin out with tur-

pentine or benzine for use. Have it very thin for soft wood, but heavier for hard wood.

Water Shellac.—Shellac dissolved with water and an alkali dries much slower than alcohol shellac. But when dry it sandpapers and rubs out just as well as the other, nor will it raise the grain of the wood as badly as the alcohol shellac does. It makes a very satisfactory coating under the varnish coats. As it does not set so quickly it can be brushed out smoother and will require less rubbing than alcohol shellac.

Mixed with a strong solution of white or brown glue, according to kind of work that is in hand, equal parts of glue and shellac dissolved in alkali make a good filler for cheap work; it will bear out the varnish nicely and give a clean job with one coat of the filler and one coat of cheap varnish.

To make water shellac take one pound of pulverized orange shellac and one-half pound of powdered borax, and a non-metal basin containing a gallon of soft water; in the water place the ingredients and set the vessel on a stove to boil until gum and borax are dissolved. There will be some residue from the shellac, hence it must be strained through cheese-cloth; boil down to a proper consistency. Some think the addition of a little alcohol improves this shellac varnish, but this is not certain; yet the addition of about eight ounces of alcohol to the gallon of water shellac may be desirable as giving the liquid the odor of alcohol shellac. Some, indeed, mix together equal parts of the shellac and alcohol, but this increases the cost. Possibly the addition of more or less alcohol may improve the quality of water shellac.

Clear Alcoholic Solution of Shellac.—To make this form of shellac pour six parts of strong grain alcohol over one part of bleached gum shellac, and shake it occasionally until the lac is dissolved,

which will require about ten to twelve hours. Then add one part of powdered chalk and heat the mass over a water bath; let it then stand until it becomes clear, then pour off the clear portion and strain the sediment through filter paper, assisting the operation with a little alcohol.

White Gum Shellac Specifications.—The specifications issued by the Navy Department, 1912, are as follows:

1. White shellac must be pure, recently bleached white shellac in hank form and free from adulterants and other foreign matter. It must not contain more than 4 per cent. of shellac wax and not more than 25 per cent. of moisture, and when treated with hot ethyl alcohol, 94 per cent. by volume, there must not remain more than 1½ per cent. of insoluble matter.

2. In case the percentage of moisture present exceeds 25 per cent. the delivery shall be accepted for an amount as many per cent. less than the actual amount delivered as the percentage of moisture exceeds 25 per cent.

3. To be delivered in barrels, which shall be marked with the name of manufacturer and gross and net weights.

Special Quick Drying Shellac.—The wood finisher sometimes finds himself in need of a quick drying varnish which will rub in a few hours and match the usual slower drying varnish. Take two pounds of bone-dry bleached shellac gum and dissolve it in one gallon of wood alcohol or denatured spirits, the latter to be preferred. When dissolved let it stand twenty-four hours, by which time there will be a clear liquid on top and some sediment on the bottom. Pour off the top liquid. This gives a varnish that is pale enough for the finest work; it will dry quickly and rub nicely. It is intended for "touching up," or for

edges that have been marred or rubbed through. But if you wish to touch up anything that has been coated with an oil or turpentine varnish and you wish to rub it, the whole surface should be coated, as the two varnishes are so different that they would not give the same gloss when finished. While it is not intended for large surfaces over another varnish, it is fine for any size surface that has not been previously coated with another varnish. It flows out more freely and dries more rapidly when used alone than it does otherwise. It should be applied freely and with as little brushing as possible, as it sets quickly. Until one learns from experience how to apply it to a large surface there will be more or less trouble in using this varnish. It rubs in either water or oil, but better in oil.

Applying Shellac in Damp Weather.—The finisher must be careful in applying shellac varnish in damp weather, especially on mahogany and walnut. Under the conditions named there is danger of the finish on these woods being greenish in cast. If you are using a white shellac in damp weather and it turns to a pale film on the wood before it becomes dry, stop work at once. If you are using orange shellac which shows a slightly greenish hue just before it sets, it indicates moisture in the air. Stop using it until the shop is right. There is no trouble when the shop is properly heated, with no windows open to admit the damp air. The heavier the shellac the greater the trouble from dampness, showing most at the edges and at the points of the laps.

Chinese Glue.—Dissolve gum shellac in ten times its weight of ammonia. The ammonia must be strong. There is on the market a preparation that is likely only Chinese glue, so called. It is advertised to be better than alcohol shellac, and that it does not raise the grain of the wood, sets slowly, dries hard quickly, flows well

and does not show brush marks, dries flat or without gloss, requires no sandpapering, and so on. Undoubtedly it has merit and will be found useful for many purposes. It can be thinned with benzine, but is not useful for floors nor for knot killing.

Shellac Varnish Notes

Venice turpentine and balsam of fir act in shellac varnish as toughеners and hardeners.

A little gum camphor added to shellac varnish will make it more pliable and easier to spread.

Castor oil retards the setting and imparts flexibility. Oil of lavender prevents frilling or chill. Boric acid enables a lacquer to adhere to metals.

Celluloid is used in the place of a resin, the transparent chip, sheet, or dust being used for the purpose. It is soluble in acetone, and after solution may be diluted with amyl acetate, benzol, etc.

Excess of moisture in shellac may be removed by placing strips of gelatin in it, these absorbing the water; they can then be removed, dried, and used again.

Old shellac becomes dull and spongy, due to the absorption of moisture and by the evaporation of the alcohol. Add a little turpentine to it.

To clean shellac brushes wash out with alcohol; then with soap and water. Alcohol will remove shellac from any surface. So will alkali.

When making up shellac varnish remember that it requires less white shellac to the gallon of alcohol than it does of the orange. For instance, where three and one-half pounds of orange shellac is used for making one gallon of orange shellac, use but three and one-quarter pounds of white.

To color shellac varnish black use lampblack; for

red use Chinese vermilion; for blue use Prussian blue. The colors should be dry and finely ground. To mix, add the color to a little of the varnish and work it to a smooth paste; then add varnish, and alcohol also if necessary, in proper quantity to make the mixture spread well.

To pulverize brown shellac place it in a strong bag and beat it with a mallet. Now and then sift out the powder and continue the pounding until all has been pulverized.

By adding about one-half ounce of oxalic acid to the quart of orange shellac varnish its color is brightened and most of its impurities are removed. After adding the acid stir the varnish and then let it settle over night; then pour off the clear solution and throw away the dregs.

When the shellac shows a tendency to work short and show frills on the work it may be improved by the addition of a few drops of lavender or almond oil.

A French cabinet maker gave this formula for making a good shellac varnish for furniture or floor work. Five pounds of pale orange shellac, one ounce of gum mastic, and five or six pints of alcohol; dissolve cold in order to prevent evaporation, stirring constantly.

If we mix rosin with pure orange shellac in the proportion of one-fourth of the latter to three-fourths of the former we get a varnish that will dry in the same time as a pure shellac varnish, while its adhesive power will be equal if not superior to the pure alcohol shellac varnish. But the pure shellac varnish will give a harder coating than the one containing rosin.

By mixing two-thirds shellac with one-third rosin we get a slower drying varnish and one with a softer coating. Still, such a mixture will give very fair results, as it may be rubbed after about four hours, the second coating giving a high gloss finish.

Camphor may be added to any alcohol varnish, but never more than one ounce to the gallon. To celluloid varnish it may be added to the extent of 25 per cent. of the guncotton.

Apply shellac varnish, made with alcohol, with a brush set in glue, alcohol not injuring such a brush.

Two coats of thin shellac are better than one heavy coat. Steel wool is better for smoothing between coats than sandpaper. Make no misses when applying shellac, and never touch-up any missed part. Keep surface smooth as you apply varnish.

Thin up alcohol shellac with alcohol, any kind that does not contain any petroleum product. Some add a little turpentine.

Filter white shellac through several folds of cheesecloth. Keep in a tightly stoppered vessel.

Ten per cent. of Venice turpentine to the shellac by weight will make it work easier under the brush.

Shellac varnish containing rosin had better be used as soon as possible as the lac will precipitate to the bottom, like a mass of rubber, and it cannot be dissolved again.

Some shellac is adulterated with Manila gum, and such shellac is not as hard and elastic as the pure article; it should contain some Venice turpentine, just a little, to overcome this fault.

It is said that about sixty per cent. of all the shellac we use in this country is T N, or "Truly Native." It represents a very dark lac, and selling at a very low price, comparatively. Where color is no object it is a very good shellac.

A medium grade of orange shellac is made paler by the use of orpiment. High grades of orange shellac are made from the best stick lac, and is gathered late in the fall from the *Palas* tree. It is a very clean grade of shellac and has little or no orpiment in it; it is used mostly by makers of high-grade furniture, for backs of

mirrors, pattern work, and for plastic or composition materials.

Garnet lac is the lac with the dye or coloring left in it; used mostly by hat makers and makers of shoe blacking; it is made pure or with ten per cent. added rosin. Once this lac was valued for its dye, the lac being thrown away. Button lac is the same as orange shellac, only it contains more natural wax. Kal is an inferior garnet or button lac, being made from the refuse from the other lacs. It contains also a large percentage of rosin. Tongue lac differs in form only from button lac. Seed lac is the same as stick lac except that it is ground and washed, the lac dye being entirely or partly removed. Stick lac is the crude lac as it comes from the trees.

On a hot, humid day shellac may become like sour cream in appearance, due to its absorption of water. In the best furniture finishing rooms shellacked articles are placed in a hot drying room as soon as they are done, this even in hot weather.

To test shellac for purity mix some with ether. Shellac is insoluble in ether, rosin is soluble, hence there will be partial solution.

Shellac is the hardest known resin. Were it possible to dissolve it in turpentine or linseed oil it would make the most durable of varnishes for exterior work in contact with atmospheric conditions. As it can be dissolved only in alcohol and alkali it is useful only indoors.

Shellac Floor Finish.—A painter with forty years' experience declares that as a floor finish "shellac is all right." That he would not give a cent for floor varnish for durability; he thinks shellac wears ever so much better. That at least has been his experience, he adds.

Objects to Shellac.—An experienced wood fin-

isher says that high-class work should not be shellacked, but be worked up from the filler with oil varnish. His reasoning is that shellac is an alcoholic finish and does not connect up with either the oily undercoatings or with the oil varnish used over it; the least rough usage will cause the varnish to chip off. He concludes that shellac should be used only on cheap work, where speed is the object.

Why Shellac Should Be Used.—The most durable finish by the use of a medium coat of shellac on the wood, says an expert finisher, has been proved many times. There should not be two coats, as some practice it, because that makes a very brittle body under the oil varnish. There is no saving in dispensing with shellac and putting oil varnish on the bare wood or filler. Oil varnish does not sandpaper well, and when used for the priming coat the next coat, oil varnish, does not flow out as smoothly as when put on a surface prepared with shellac.

Finishing Refrigerators.—A refrigerator plant using the sprayer say they formerly used shellac on the first coat, but found that a cheap grade of varnish, called a surfacer, gave them better results. They now apply three coats of varnish, including the surfacer. The finisher explains that shellac dried too rapidly, but that the air spray shoots the varnish surfacer right into the wood, and not being such a quick drier it penetrates better than shellac. Most of these refrigerators are made of birch, and three coats of varnish make a handsome finish.

Spraying Shellac Varnish.—A contributor to a trade paper catering to the wood-working trade gives his reasons for not using the air spray machine for applying shellac varnish. Among other interesting things his article contained was this: "I do not believe shellac, genuine or artificial, should ever be sprayed, as

shellac varnish is a liquid that will not stand a draft of air and has no flowing quality, but is intended to lie as it is applied. Very few men, even though good brush hands, can do a first-class job of shellacking; therefore, applying a coat with an air sprayer you are working against the nature of the material, leaving it as the air has placed it, in a mottled condition and making a foundation that is far from what it should be. Spraying shellac is, I think, responsible for much of the pinholes that we hear so much about now. In sanding it takes more paper and more time than is required by a hand coating, not giving as good a surface nor body."

Says another finisher: "In my opinion the spraying machine is a very necessary article; I do not believe that we shall ever get as good a job with it as with handwork, but the difference in the quantity of production makes it far more desirable than the old-time handwork. Nor do I believe that it will do all that was done by hand, or as good in every case."

Both brush and sprayer should be used together. The sprayer will not drive the filler into the pores of the wood far enough to make a first-class job; but if the sprayer is followed closely by the brush a satisfactory job can be secured. Let one man do the spraying, followed by another man with the brush. This is the conclusion arrived at by an expert finisher. This, of course, applies only to the open-pored woods, as the close-grain woods do not have to be paste-filled.

For birch or similar woods it is not necessary to brush the filler, the cleaning-off process will insure enough filler in what grain there is open to receive it. Only birch that has been stained with water stain will need filling. When this wood is to be finished in its natural color, or is stained with an oil stain, filling is not necessary, for the surface is sufficient to fill the

pores. But water stain opens and enlarges the pores, and filling is needed to fill the pores and to avoid pinholing. For birch or other woods that have been water stained the filler should contain a larger quantity of oil than is required for wood that has not been so treated, otherwise the filler will give the work a clouded appearance. But if a very thin coat of shellac is applied before filling, additional oil will not be necessary, because the shellac will prevent the too rapid absorption of oil from the filler.

"Experienced Finisher" writes as follows: "My experience has taught me that a smoother coat of shellac can be applied with the sprayer than with the brush. The shellac must not be used over two and one-half pounds to the gallon. The mottled appearance on sprayed shellac surfaces is caused by a too heavy-bodied shellac. The evaporation of shellac applied by the sprayer is greater than when the brush is used, hence the shellac must be much thinner. Application of shellac at a low air pressure involves less evaporation and gives a surface requiring less sandpapering. And better results are obtained by working close to the surface. A number of plants are eliminating 30 to 50 per cent. of shellac sandpapering by spraying it under the conditions I have named."

Applying Filler with Sprayer.—The sprayer does not and cannot work the filler to the bottom of the pores. It is a quick and easy way to apply the filler, but that is all. Unless the pores are full the surfacer or varnish coat will sink in more or less, and hence more varnish is required and more time consumed in the finishing. It is no advantage to apply a uniform coat of filler nor a heavy coat if enough has not been gotten into the wood.

HOW TO USE THE AIR-SPRAY MACHINE

WHATEVER may be said against this machine, it is a fixed fact in furniture manufacturing, in the finishing room, and must be accepted as such. One writer declares that "practically every piece of furniture produced (in recent years) has had the greater number, if not all, of its coats applied by the spray method." We cannot do better, in this article, than to quote from a writer in *Veneers,* in its issue of September, 1920.

"In order to get the best results with this new method, which so quickly adapted itself to the varied lines of finishing, it is essential to know its use, be adept in its use, know the materials to be applied, and know when they are properly applied. It will not take as long for a finisher to become proficient in the use of the spray as it did for him to become expert in the use of the brush, but let me impress on those taking to the spray method that it is important to know its advantages and its limitations.

"To get the best results by the old method it was necessary to maintain a high degree of cleanliness, and this is just as essential in this modern method of finishing. Brushes always had to be kept in first-class condition, and just so with the spray machine. If condition and quality of brushes were a pride to the brush hand, the condition and quality of the spray machine should be the pride of the spray operator also. To get the best results out of any piece of machinery it must be clean, well-kept and not abused. The spray machine must be kept well oiled and always in perfect working condition. This, it might be

thought, is hard to do and requires a lot of time. On the contrary, if five minutes are taken at the end of the day to clean it and oil it, the operator will be more than repaid by its smooth working during the operating hours.

"Surfaces to be sprayed should be cleaned before applying finish. Usually this is handled by blowing dust and dirt off the surface with an air duster, while article is in booth, in position to be sprayed. The exhaust fans in booth draw out this dust, eliminating its spreading in finishing room for work requiring high-grade finish. The finishing room, as when brushing, must be as nearly dustproof as it is possible to make it. It should also be roomy, light and well ventilated.

"Beginning at the air-compressing plant, the 'don'ts' and 'precautions' to be taken are as follows: Water and oil in air line are the source of considerable trouble; water affects nearly all varnishes, and spotted effects on the surface result. Oil will make the surface look mottled. If the air receiver is drained once or twice daily, or oftener in certain localities where the humidity is high, and a condensing arrangement is inserted in air line in proximity to where sprayer is used, water trouble can be practically eliminated. Oil is removed by filtering air, and here it is essential to remember that the substance used in filter should be changed occasionally. Once this substance becomes oil-soaked the pressure will force oil through, only a small amount being required to spoil a day's work.

"Temperature is an important factor to watch. Temperature of work, of room and of material should be the same for best results. In warm weather there is practically no trouble from defects due to temperature, but once cold weather sets in these defects loom up in full force. Spraying varnish at 40 degs. on a

surface 50 degs., with temperature in room 60 or 70 degs., will give one the finest kind of an example. The varnish, being cold, is in a congealed state, and of course is not broken up as fine as it should be. And cold varnish applied on a chilled surface gives work the appearance of a sand-strewn coating. This is the natural result of the material not being applied heavy enough and the heat in room not being sufficient to cause proper flowing out.

"Where varnishes, or materials containing varnish as a vehicle, are used a heater for material is recommended. This allows one to apply varnishes heavier and to save time, labor and material. The saving of material is effected by eliminating one or more coats. Improved results are insured through better flowing out of material.

"The sprayer itself is a mechanical device, and as such requires lubrication, care and cleanliness. Many minor faults found in use of spraying equipment could be entirely eliminated by the use of common sense by the operator. On any machine, when a part is removed, great care is taken to replace it exactly as it was. Just so with the spray machine. If certain parts had been screwed up tight they should be replaced the same way. Occasionally an operator has difficulty with the machine spitting or producing a heavy spray on one side. This is due entirely to tinkering with the equipment and not using proper precaution to put back parts exactly as they were originally. My experience has been that both time and money are saved by sending the machine to the factory for repairs when something radically wrong turns up. It is my further experience that to avoid any hold-up in production it is advisable always to keep one or two sprayers in reserve for just such an emergency.

"Pressures at which to apply various materials must

be left largely to the discretion of the operator, he knowing the amount of work, quality of finish demanded of him, and the grade of material he is applying. Stains usually are applied at pressures ranging from 30 to 40 lbs.; shellacs at 30 to 45 lbs. pressure; varnishes at 50 to 80 lbs. pressure; this range of pressure allows for various grades of material. Proper working distance from work is from 6 to 8 in., and in some cases slightly more. Best results are always obtained by staying as close to the work as consistent with good spraying practice, using the least amount of air pressure required to break up the material thoroughly. By following these suggestions a worth-while saving of material will surely be effected. Further experience has taught me that: (a) Fillers should be applied at as low an air pressure as is possible; should be mixed about 10 lbs. per gallon for open-grained wood and about 8 lbs. for close-grained; they require agitation and should be handled through pressure feed containers. (b) Stains used while hot are better, the penetration being greater; if work has been glue-sized before being belt-sanded, stains should not be used hot, but merely warm; the electric heater can be used to advantage in the latter case; gravity-feed containers work out better in the handling of stains.

"Too much importance cannot be attached to the quality of fillers used and their application. About nine out of every ten cases of trouble can be traced to this first step of the finishing operation. This is the base of pinhole trouble, which is found more or less in built-up wood. Trouble of this nature can be eliminated if care is taken to see that there is enough binder in the material. Binder holds the filler in the pores of the wood, and if enough has been incorporated the filler will not pull out in the rubbing process. This defect can be detected, before any shellac or var-

nish is applied, by using a magnifying lens and examining the filled surface.

"Shellac for spraying should be cut not more than 2½ lbs. to 1 gal. of alcohol. While some shellac substitutes should be reduced 50 per cent. and others more. A substitute that is too heavy will leave a pitted surface, while one too light will bubble in the grain of the wood, the final result being clear to all of us; 30 to 45 lbs. is the range of pressure at which shellac should be applied. Gravity-feed containers are best adapted for handling shellac.

"Best results in spraying varnish call for the use of the electric heater. Heating material gives better flowing qualities and eliminates reducing. The heated coat, liberally applied, many times saves going over the surface more than once. Never spray so as to cross the coats. Pressure-feed containers are more suitable for the handling of varnish, allowing the operator to use less air to break it up; six to eight pounds pressure on material is all that is required to force it to the nozzle of the sprayer. Too much pressure on material will cause sprayer to sprinkle or split, the reason being that more material is flowing from the nozzle than the air is able to atomize properly.

"Just as is the case in every factory department, there are times when little troubles arise in the finishing room equipped with the spraying machine. However, these seldom involve serious difficulties. There is always some good cause for all happenings, and the easiest and quickest way out is to calmly locate the cause and apply the remedy that practice and good judgment usually suggest. If the problem encountered appears to be insoluble put discouragement to one side and call up the maker of the machine for help. He will help you out, no doubt.

"Concluding, let me emphasize these points: Tem-

perature of workroom, job and material; air pressure; purity of air; quality of materials applied; cleanliness of work and room; condition of sprayer and its care."

The following additional information is from a finisher who has had considerable experience in operating a sprayer. He says:

"After making sure that our machine is in perfect condition, by brushing on a coat of shellac we have started to build a smooth foundation for the varnish coats, and should get a satisfactory job; if we don't there is something wrong with our method of applying the varnish. Some heat the air and some the varnish, but I believe both should be heated to the same temperature. Most of the heaters, I believe, do not do this. I think a heater should be built that allows the air and varnish to travel through the same distance, coming in contact with the same heating coils, so they will have the same temperature when they reach the gun.

"Some operators stand too far away from the article being sprayed. The distance where the best results are obtained should be observed and the operator should maintain this distance as nearly as possible. Just because the gun is throwing out the material is no sign of good results, for if a thermometer is held at the end of the gun it may show a temperature of 80 or 90 deg., and when held at from 36 to 40 in. away it may show lower than the room temperature. Varnish passing through the air in the cabinet cools faster than it can be heated, for it is not only being blown with air, but is passing through a circulation of air caused by the fan in the booth.

"As an instance of what excess air will do, I visited a plant making desk tops approximately 6 ft. wide. The operator started his varnish from the opposite side, working towards himself. Each time he crossed

the top he blew the air over the part varnished, causing it to set so it could not flow out. By reversing and starting on the edge nearest him the air from the gun would not have come in contact with the varnish already applied and it would have flowed out in a satisfactory manner. We have all been taught never to apply varnish in a draft, yet this man expected to get good results by making a draft over his work.

"Very good results are obtained by placing the varnish drum on pipes arranged to keep it at an even temperature. Such a rack can be built where any large amount of varnish is used, and may be made to heat two or more drums. I would recommend keeping them a little warmer than the room temperature. If the spraying machine is not working all right it is only necessary to give the methods employed a little thought to find the cause of the trouble, and I hope the suggestions I have made will help to locate any difficulties."

Sap and Seasoning.—In no other wood does it require so long a time for the sap to die as in rosewood; in other words, for the albumen to coagulate. If the wood finisher ever wonders, as he often does, why rosewood acts so badly under his finishes he will find the source of his trouble in the slow drying of the sap. This sap acts upon the varnish, and this is especially annoying to piano finishers who use rosewood largely in their work. An expert finisher offers the suggestion that the wood be treated with a weak solution of phosphoric acid, then with alcohol. But he had never tried this, it being merely his theory, based upon the idea that the acid would act upon the albumen, coagulating it upon the surface of the wood immediately, while the alcohol would reduce it to an insoluble state.

Oak is another wood that acts badly sometimes. This action is due to its tannin content. When oak is cut in the growing season it contains more albumen than when cut in the fall, after growth has ceased for the year. This explains the difference of conduct of oaks when being stained and finished, some doing well while others act badly. The oak is full of albumen, which in the circulation of the sap deposits a large amount of soft matter on the lining of the wood cells. If this matter contains any tannin it will act upon the filler; it acts especially upon a starch filler, and many gums, used in fillers, are affected in the same way, becoming quite soft.

Then there is a difference even in the same species

of woods, say, between French and American burl walnut, or Italian and Circassian walnut, which is well known to wood finishers. There is a difference in the vascular formation of the woods, no doubt, and this must account for the varying results with identical treatments. The woods named require very different treatments at the hands of the finishers in order that satisfactory results may be obtained. And the only way to get this satisfactory work is by knowing just what will suit each kind, and to know one needs to study and experiment.

The finisher should have a microscope for examining the wood structure, for this will give him a better knowledge of the structural character of wood than can be obtained by the unaided eye. And the same with a filled surface of wood; when the finisher looks over his filled work and it appears to show a filled and solid surface it will be a surprise to him, in many cases at least, to take a look at it through a microscope, even one of small power. Take a piece of oak and fill it. Likely some parts of it will be soft and close, while other parts, and perhaps the larger part of it, may be hard and very open-grained. Now the same filler will not do equally well here; or the same rubbing off, for we may rub filler out of the large pores and sufficiently fill the smaller pores. The filler for the large pores must be rather stiffish, whereas for the closer-pored wood it must be rather liquid. Now with the microscope we can see exactly how the work is, whether right or not. We have seen furniture where the varnish seemed to have sunk in, while other parts stood out plump and full. We have just told how this may come to pass.

Staining the Ends of Boards.—The ends of the boards take up stain like a sponge, and this gives the finisher not a little trouble. The ends show up much

darker than the rest of the work. One way to overcome this trouble is by filling the ends full of paste filler, but you will need to be careful not to get too solid a filling there, for that would result in it showing its color, hiding the wood, and giving an opaque effect. Another way is to wax the ends, either by placing wax on them and then heating it in with warm iron, or by applying the usual wax finish, such as comes prepared for floor waxing. The smoother the sawed ends are the easier it is for the finisher to do a good job.

Shop Economies.—Instead of destroying the life of a filler by excessive thinning, done to hasten the work, use it as heavy as possible and then rub it in thoroughly. The filler is about the cheapest article used by the finisher, but the man who uses it should be competent; yet an inexpert man may do it and do it well, though it cannot be said that boys, whose labor is still cheaper, will be likely to do it as it should be done. The idea is to save by having the lower priced man do the filling. It is said that at least twenty-five per cent. can be saved in this way. The labor cost is computed to be eighty per cent. of the entire cost of finishing.

Take care of the tools, brushes and stock of all kinds. Keep varnish and filler covered, free from dust and dirt; have volatile liquids well stoppered to prevent waste by evaporation. Much waste occurs with tow, used for rubbing out the filler; after having used it until full do not throw it away, but let it become dry, then shake and pull it loose, and it will be as good as ever. Sandpaper is wasted by being worn smooth and then thrown away. Save it for smoothing certain fine work or small moldings, etc. Keep the varnish brushes clean and in a keeper, not allowing them to become lousy (full of dry sand-like specks).

Staining Wood before Working Up.—The idea of staining wood before the woodworker takes it in hand, so that all the wood finisher will have to do will be to varnish it, has engaged the attention of the inventive for some years, and certainly its consummation would bring joy to the hearts of wood finishers, whose troubles with stains and staining are about the worst they have to endure. One man suggests staining the wood while it is yet on the hoof, as it were, or in the tree. This idea has been experimented upon for many years, and from time to time there have been announcements of remarkable results obtained by this process. It has been claimed, though of course never proved, that almost any color scheme may be developed in this way; in fact, it would seem that even the barber pole might be thus made, only needing to be varnished after the wood worker had shaped it. That idea is brilliant.

Another idea along the same line consists in injecting coloring matter into blocks and logs. Some wonderful results have been obtained from this process, for it is of course entirely practicable. For instance, the color design of the stars-and-stripes and other national flags have been forced into timber so that when cut up into blocks the color design makes its appearance on the finished surface of the block. This is a German invention, said to have been in use for some time, but it does not appear to have been a commercial success.

In our country we have steamed cabinet wood under pressure to harmonize the color and deepen it a little, as well as to hasten the process of seasoning. This is classed as a method of seasoning, but it does have some bearing on the matter of coloring or staining wood before using. There are some who use practically the same process and, by injecting certain chemicals, bring out certain stains or colors in the wood.

Some call this a vulcanizing process, and it is especially adapted to oak, mahogany, gum and cherry; it should also be useful in preparing veneer for use, as it should be practicable to give them all a uniform color, and thus not only to complete the staining before using the veneer, but make it through and through the wood, so that there will be no possibility of the stained surface working off.

Imitating Old Mahogany.—This may be done with a weak solution of bichromate of potash, in water, or by fuming. Weak lime water antiques it, making it rather red. The antique effect may be had by means of a mixture of two parts of turpentine and one part raw oil, well rubbed into the wood, afterwards wiping it off dry. Then apply a coat of water solution of bichromate of potash. When that is dry fill the wood with mahogany paste filler; finish as desired, shellac or oil varnish.

Mahoganizing Other Woods.—A French method of mahoganizing other woods consists in giving the wood a coat of diluted nitric acid, which is to be well rubbed into the wood. Then stain with a mixture of one and one-half ounces of dragon's blood dissolved in one pint of alcohol, which must then be filtered; then add one-third its weight of carbonate of soda. Apply this mixture with a brush, repeating this at intervals until the surface has the appearance of polished mahogany. In case the luster should fail it may be restored by rubbing with cold raw linseed oil.

Finishing Fireproofed Wood.—Woodwork is made fireproof by forcing certain chemicals or salts into their pores by pressure. While these salts remain dry there is no trouble, but should any moisture get to them the finish of the wood is sure to be injured. The salts act especially upon woods containing tannin, darkening and marring the beauty of the wood. In

some cases only paint can be used upon such treated wood. The salts might be neutralized in some way, but there does not seem to be any way. The best finish, other than oil paint, is hard gum copal varnish.

Staining and Finishing House Trim.—For the soft woods the oil and turpentine stains do well, particularly on the bare wood. For staining pine and spruce with light or dark oak, cherry or mahogany stains, use plenty of oil and driers. There are many soft places in pine that show up much darker than in the rest of the surface, because of the greater quantity of stain absorbed by its sinking in. By using oil rather than turpentine the stain does not sink in so bad, and the whole surface will have a more uniform color. Then it gives a better foundation if it is to have only one coat of varnish. Sometimes there will be as many as three kinds of soft wood in one room, such as pine, bass and spruce. It requires skill to get uniformity of color when staining such work. About three pots of different stains will be required.

Where wood is not strictly first class many parts will be soft and punky, and in such case give it a coat of oil and turpentine, half and half. And a stain containing rather less oil than turpentine will do best. After the oil coat is dry, and if the work has been wiped carefully, a good result can be had.

Whereas basswood or whitewood can be stained mahogany, cherry or rosewood successfully, the pine of to-day can rarely be stained to imitate another wood.

Yellow pine can be finished very nicely in oak and brown colors, as also green weathered effects. But this wood is not so well adapted for the red colors, mahogany and cherry. Nor does the wood always take the stains alike, and it is necessary to have two pots of stain; even then the color may not be uniform, although the effect will be pleasing. The stain requires much

driers, and it should be wiped over; usually two coats of varnish will then give a good finish, dull or gloss. Trouble is sometimes had with doors which seemed perfectly clear and ready for staining, but which after the staining showed up cloudy and blotchy, probably due to rain, or water in some form, and only scraping will remove it.

Violin Varnishing.—The ancient violin makers used a varnish made from fossil amber, and the varnish was colored as follows: Golden yellow, golden amber, golden orange, light golden red, dark ruby red, deep blood red, reddish-amber, golden brown, reddish-brown, and very dark reddish-brown. The wood was not stained, but the varnish was. The wood was first sandpapered smooth and a coat of very pale varnish was applied, this being rubbed into the pores of the wood; after a week another coat of varnish was applied. This second coat was rubbed down and polished; then colored varnish was applied, from two to five coats, until the required depth of color was obtained. To do a real good job requires about three weeks, and a finer job will require longer time. The varnish dries slowly, hence produces a tough finish, one that is very durable. Where a cheaper job must be done a different course will be pursued; but a too rapid drying of the varnish will impair the tone of the instrument.

Piano Finishing.—The process of piano finishing has changed to some extent in recent years, or since dipping came into vogue. But to get the finest finish the old methods still are necessary. It used to require about three months to finish a piano, including the gluing. The wood must be made perfectly level and smooth, like the best plate glass. The highest grade of materials is used. The wood may be mahogany, oak, walnut, or other; and it may be veneered or

stained black, but in all cases, excepting as to the stains, the treatment is the same. Vegetable stains are the only ones that will do. Two coats of stain are given. Then two coats of filler, with the usual rubbing off, with forty-eight hours before sandpapering. The paste filler is always stained. After the rubbing off the surface is sandpapered smooth. Sometimes one coat of paste filler does; perhaps in most cases one filling will do; the finisher is the judge of this. Then the rubbing varnish is applied. This varnish must be the highest grade, not too heavy of body, and it should be applied in a room having a temperature of not less than 70 deg. Fahr. From five to seven coats of this varnish is given, with one week between each for drying, each coat being rubbed down with fine sandpaper. The last coat of rubbing varnish is rubbed down with fine pulverized pumicestone and water, using a felt pad for the rubber. The pumicestone must be perfectly free from grit, and it is usual to sift it through a fine hair-cloth sieve; the American pumicestone is too coarse and gritty. Wash off with plenty of clear water, washing out every particle of pumicestone, then wipe dry with clean, soft, wet chamois. Now the job is ready for the polishing varnish, which is flowed on freely and brushed out level; use a very soft hair brush. After the job has stood one week it is rubbed with powdered rottenstone and water, using the palm of the hand as a rubber, and continue until a desired polish appears. Then wash off with clean water, dried with the chamois, and rubbed with a few drops of sweet oil on the palm of the hand. The oil is then spirited off with clean muslin moistened with alcohol. Some use cornstarch in place of alcohol, which is rather risky to use on account of its action on the varnish when overdone. But cornstarch does not give as clean a surface as alcohol does, but is safer in the hands of

the careless or inexpert. Clean with a cotton rag.

A week is usually given for a coat of varnish to dry, but sometimes ten days are given, and even two weeks would not be too long. This because of the number of coats given, the under coats requiring extra time, owing to the fact that most of them are sealed against the air by the upper coats. Much trouble comes from not having the varnish coats sufficiently dried before the succeeding one is applied. In piano work, too, the varnish must be right or other troubles will come. For some kinds of work kauri gum varnish is the very best, but for piano finishing only Zanzibar gum varnish should be used, as it is the hardest gum known. Even when carrying the same amount of oil as the kauri gum varnish it will give a much harder surface, and hence it polishes better. Moreover, a hard varnish is necessary, owing to the usage the piano case will get. For the best results the finisher must use a quick drying non-elastic varnish for all the coats but the finishing, which must be very elastic.

Finishing Antique Oak Piano Case.—Apply the usual dark oak water stain; next day, when dry, sandpaper smooth and fill with paste filler. Rub filler well into the wood, using a leather pad. Let it stand then until the twelfth day, then give it a coat of orange shellac; next day sandpaper it, then apply a coat of piano rubbing varnish. On the twenty-third day give it a coat of piano rubbing varnish. On the thirty-first day give it another coat of piano rubbing varnish. On the thirty-ninth day still another coat of piano rubbing varnish. On the forty-seventh day another coat of rubbing varnish. On the sixty-first day scour with pulverized pumicestone and water. On the seventy-fifth day flow on a coat of piano polishing varnish. On the eighty-ninth day rub lightly with fine pumicestone and water. On the ninety-first day rub to

a surface with pulverized rottenstone and water. On the next day dry-polish with the palm of the hand, using powdered rottenstone. On the next day oil-off and clear up with alcohol.

Another Piano Finishing Process.—While the case is in the woodworking shop sponge it off with clear cold water; let it dry, then sandpaper it carefully. Next apply a paste filler, which rub well into the wood with the leather pad. Let the job stand three days, then sandpaper with No. o paper, then apply the primer. On the seventh day sandpaper lightly with No. ooo sandpaper until the surface is perfectly smooth. Then apply a coat of kauri piano rubbing varnish. On the twenty-first day sandpaper as before, and apply another coat of the rubbing varnish. On the thirtieth day rub with No. 1 powdered pumicestone and water to a surface. On the thirty-fourth day apply a coat of elastic Zanzibar piano polishing varnish. On the forty-sixth day rub lightly with No. o pumicestone and water. On the fiftieth day flow on a coat of Zanzibar polishing varnish. Sixtieth day, rub with powdered rottenstone and water. Sixty-fourth day, dry-hand polish with refined velvet lampblack, and then wash off with clear cold water.

Finishing a Rosewood Case.—With the exception of the stain the process given for finishing oak case may be used in the finishing of a rosewood case, whether light or dark rosewood. To do a dark rosewood case apply a coat of alcohol red stain, then sandpaper smooth and fill as directed elsewhere for rosewood. After the filling comes a coat of orange shellac, which is to be glazed over with asphaltum varnish. After this point you may proceed as directed for the dark oak case, beginning with the process indicated for the thirteenth day.

Mechanical Varnishing.—Modern factories that

are strictly up to date are using a mechanical varnishing machine, which is composed of a rack on which several parts of a frame are placed on end, side by side. Each rack holding the parts of six pianos, the frame is placed in the machine, which slowly immerses it in a vat of varnish, where it is allowed to remain for a brief period, when it is slowly drawn out. The drawing from the varnish vat is done so slowly that the motion is scarcely perceptible to the eye, and it is so done that the surplus varnish flows away without streaking, coming out uniformly smooth and level. The method saves time, which means money, and makes each part damp-proof, which is especially important in the shipping and exporting of the goods. The varnish preserves the glued parts from the action of moisture.

How to Prevent Cracking of Varnish.—Some piano makers refuse to ship their instruments in cold weather. One firm which makes a medium grade of pianos, but which are well finished, state that they use only air-dried lumber, making solid cases, and do not use shellac. They body-up with a quick varnish and polish on a slow varnish. During the two years that they have been doing this they have not had one instance of varnish cracking. To avoid cracking the undercoats must be quick drying, non-elastic, but with an elastic finishing coat. They give less time to the drying of the undercoats than to the finishing coat; this latter coat should have time enough to become quite hard, which is essential to good polishing. If, however, insufficient time is allowed for each coat to dry there will be varnish-checking. It might be supposed that one or two weeks would suffice, yet to be positively dry within that time it would be necessary to oven-dry it—and one piano maker did try it, with ill success; the heat destroyed the glue.

Trouble with Shellac Finish.—A piano finisher once wrote me that he was having trouble with his finishing. French polished surfaces, on which white shellac had been used, showed up milky or gray. He added: "We very often have this to occur shortly after the work has been rubbed, while again it will not show until several weeks after the rubbing. In nearly every case the work looked clear before the rubbing, and even after the rubbing, and we have tried many ways to overcome the trouble, but with very little success, if any."

That trouble was probably due to water in the white or bleached shellac. There has for years been trouble where pianos have been finished with white shellac, and it is unavoidable where such varnish is used as a rubbed finish. For years piano makers have sought for a remedy, but without success. The evil manifests itself in an unsightly exudation, which was once supposed to come from the oil used in the polishing, but is now attributed to the wax which exists in shellac. This wax is found to run from six to seven per cent. by weight, and it can be removed. First let us explain how the wax affects the finish. It combines with the oil used in polishing, and with it forms a soft, greasy compound that prevents the polish from hardening properly. It also causes the finish to be very sensitive to changes of temperature, and to be susceptible to injury from wear or use. This greasy matter exudes from the polish after a time, causing the trouble that the piano finisher complains of in his communication. It is a sort of efflorescence, which greatly impairs the beauty of the finish. Now, there is a process whereby the fatty matter may be separated from the shellac by agitating a strong solution of alcohol with fresh stick-lac or seed-lac, or filtering on

this lac. Thereby the readily soluble resin, as well as slight quantities of coloring matter contained in the fresh lac, are extracted from it, while the more slightly soluble vegetable wax is separated from the solution. By one or more treatments of the concentrated solution of shellac with fresh seed shellac a clear alcoholic solution free from wax of the shellac resins is obtained, which is not practicable by simultaneously dissolving the shellac and seed lac in a sufficient quantity of alcohol.

Such a shellac resin solution freed from vegetable wax has not heretofore been employed as a furniture polish, neither would it be satisfactory for the purpose, for it is too "short" and lacks in pliancy, rendering it unsuitable for being readily and uniformly rubbed into the wood. So far it would seem to indicate that we are no nearer the end of the trouble than we were at the beginning. But the chemist tells us how the difficulty may be overcome. To the shellac solution separated from the vegetable wax a medium is added which fully takes place of the wax as regards pliancy and polishing qualities, without exhibiting its undesirable after-effects. Such a medium has been found in the essential oils, especially in oil of rosemary. The formula for this new shellac is: Twenty parts shellac and four parts gum benzoin are dissolved in as little strong alcohol as possible, with the addition of one part oil of rosemary. This strong solution is then repeatedly filtered over fresh stick-lac until the vegetable wax in the solution is completely abstracted and the solution has become perfectly clear.

Another authority describes another way in which this fatty wax may be removed. Add some 62 deg. benzine to the alcoholic solution of shellac, agitate it well, then allow it to settle; now draw off the strata

of benzine in which the wax has dissolved, and so obtain the shellac solution clear and free from the objectionable wax.

Imitation of Woods by Printing.—Considerable work is done by the roller process of transfer, by which cheap woods are so treated that very clever imitations are made of the finer and costlier woods, all of which will be described under this head.

The Roller.—The roller should be made from strong, light, well-seasoned wood. For doing small parts, like windowsash, for instance, make the roller a little greater in circumference than the length of the surface that is to be printed on. This roller may be the segment of a circle of wood, in the form of a rocker, or it may be made in this manner: The shaft, extending about four inches on either end of the roller, to use in rolling, contains about twelve one-half inch spokes, around which is to be bent a strip of quarter-inch gum wood to form the roller. Make the handles smooth. To make the large roller make a circular head of one-inch board, three-fourths to one and one-half inches larger than the roller. Cut the edges of the heads true, and fasten down close to the roller; secure same firmly with bolts made to hook over the spokes of the roller. Fasten the head down true, so that it will form a flange of equal depth all around the roller. Now turn the roller over and stop all holes with plaster of Paris; the best way to do this is to run the plaster all around the inside of the roller; for there must be no leaks. In the head of the roller, as it now stands upright, cut out three or four holes along the edge of the head, about one by two inches, to allow pouring in of the composition and escape of air. Now take a long and smooth strip of zinc that will be sufficient to enclose the roller, rub it well with grease or oil, then place it around the roller, oiled

side in. Be sure to get the zinc well greased or oiled, to keep any of the composition from adhering to it; apply oil or grease in plenty and rub it well into the metal, rub off the surplus with a rag, then rub off with the bare hand. A very large roller will require the zinc fastened with collar bands. Draw the zinc around the heads of the roller and pour in the composition through a strainer. Let it stand twelve hours before removing the zinc.

For a smaller roller make a light wooden frame of a required size, as a mold, set in plaster of Paris on a piece of zinc or glass. Into this mold pour the composition, and on top of the composition lay a piece of canvas. When cool attach to roller or rocker, fastening the edges and ends of the canvas with tacks.

THE COMPOSITION.—Take twelve ounces of raw linseed oil and heat to near the boiling point, then add one ounce of chloride of sulphur; in another vessel melt two pounds of the best white glue and add eight ounces of glycerine; in dissolving the glue use as little water as will suffice. Now mix and stir all together.

Another method: Melt twenty-seven parts of the best white glue and add to it twelve parts of the best commercial glycerine; add also a small quantity of molasses and raw linseed oil. For a roller weighing from ten to fifteen pounds use one-half pint of molasses and the same of oil. To test the composition for consistency cool a little of it, and if it proves too hard add a little more glycerine; if too soft add a little more glue. Keep the composition hot. It will not injure it to boil; in fact, it is better for the boiling, as boiling expels surplus water, which should be removed.

USING THE ROLLER.—Prepare a sample board of the kind of wood you wish to imitate and print from, selecting as good a specimen as possible, with good markings. The board should be six inches wider and

one foot longer than the circumference of the roller. Dress the wood carefully. Fasten thin strips all around the board and extending an inch above the board; bore a half-inch hole in one corner, for use when cleaning off the board. Now take a half-box of concentrated lye and dissolve it in hot water. Pour it out on the board and let it remain about twenty minutes, then run it off and wash the board with clear water until no trace of the lye remains. When the board is perfectly dry, smooth it up with fine sandpaper. Then try the board, apply the color to ascertain whether the grain is sufficiently eaten out for the printing. If not, then give it another bath of lye. The lye eats away all the softer parts of the wood, leaving only the harder parts, or the grain and heart, leaving the board like a zinc etching.

THE SCRAPER.—You will need a scraper, which can be made in the following manner: Take a piece of clear white pine board seven-eighths inch thick, four inches wide and twelve inches long. In one edge of this board cut a groove one inch deep. Set in this groove, with glue, a firm piece of sole leather one and one-half inches wide and as long as the board. Plane off the edge of the wood clear down to the leather to a rather blunt edge, and be sure to get the edge perfectly true. This tool is your scraper, for removing the surplus color from the impression board, or printing block.

THE PRINTING COLOR.—Water color cannot be used. Use colors that are ground in japan. Make the printing color a little thicker than ordinary paint. Strain it onto the board and spread it out evenly with the scraper, taking the tool with both hands and pushing it forward, pressing down hard. A new board is rather difficult to make clean enough to get a good impression from, so that it may be necessary to run it

a few times before doing the work of printing, to make it clean. Have just enough color in the pores of the wood so that they will be level full, the surface being clear of color, which will then ensure a good, clean impression. After the board has been in use for a time it will clean off nicely by running over it once with color. The japan colors used may be thinned out with turpentine, making a paste, then add a little boiled linseed oil to prevent the color from getting too dry while on the board.

Having coated the impression board with the color, take the roller in both hands; choose a point on the roller to start with, then put the roller down on the board; press evenly and firmly and roll it along the board until a full revolution has been made, being careful not to go beyond that point, for that would cause a lap on the roller; now pick up the roller without letting it slip on the board and place it carefully on the surface that is to be printed, beginning with the same point of the roller that you began with on the impression board. Roll firmly, evenly, steadily, and do not let the roller slip. This should produce on the prepared surface a perfect copy of the impression board, in the same way that printers get impressions from wood cuts or etchings.

Care of Roller and Board.—After making the impression required clean off the roller with a rag dampened with benzine, then run the board as before, taking another impression, and so continue until you are done printing. Then clean off the board with benzine and stiff brush, removing every vestige of the printing color. Should the impression board have become more or less clogged with color you will have to resort to the lye, but be careful that it does not eat too long and thereby injure the print. Finally, clean off with water, let the board dry, then put it away

until wanted for the next job. Clean the roller carefully with benzine and set it in a cool place. A certain degree of heat will melt the composition, otherwise it will keep a very long time.

Wood Finishes in Favor.—Among the various color effects in popular favor as this is written are:

For Oak.—Natural, light antique, dark antique, golden oak in various shades, forest green, Flemish, weathered, cathedral, fumed, Antwerp, brown, etc.

For Ash.—Natural, light and dark antique, golden oaks or brown and black tones, and all colors that are used on oak.

For Birch.—Natural, mahogany, forest green, and silver gray.

For Mahogany.—Tuna, light and dark effects, all shades, and old mahogany.

For Walnut.—Natural and dark.

For Cherry.—Similar to birch finishes.

For Chestnut.—Similar to oak finishes.

For Maple.—Natural, pearl gray, silver gray, and all shades of mahogany.

For Cypress, Pine and Whitewood.—Natural, oak, mahogany and walnut liquid filler, golden oak, Flemish and Antwerp shades, brown oak, forest green and green weathered, etc.

For California Redwood.—Similar to pine finishes.

The Grays in Oaks.—Oak grays are not new, as they seem to have originated at the St. Louis Exposition, held several years ago, where the German contingent showed considerable of this kind of coloring. But apparently the first efforts in this direction did not meet with success, but it finally took. The gray idea was first used more generally on maple than any other wood. There were finishes known as silver gray on maple even previous to the St. Louis Exposition, so

that the finish has been used many years. About five or six years ago the gray idea got into the oak field in various shades and finishes of gray, resulting in a mingling of gray effects, together with the mission and with the tobacco-brown finishes, all of which became very popular.

Some of these grays are striking and attractive, but all of them are rather cold in appearance; they answer very well for summer furnishings, but are rather cool for winter. Silver-gray is a popular finish in the Mission style. For description of grays and formulas see heading, "Wood Stains and Wood Staining."

Colombian Mahogany.—More than twenty mahogany-like woods are now available as true mahogany. Interest is attached to such woods as Cariania or Colombian mahogany, not claimed to be real mahogany, but very like it in grain effects and working qualities, so that it may be finished in close imitation of the real thing. It is undoubtedly a fine cabinet wood, and has many good qualities, for when properly seasoned it will not warp, check or shrink, while much of it is very beautifully figured. It takes the filler well and is susceptible to a high polish. When skillfully stained and finished it requires an expert to tell it from real mahogany.

Filling Checks in Veneers.—To fill the checks that appear in veneers after they have been glued up so that they will not show, try the following plan, given by an expert woodworker: Take fine sawdust derived from the wood the veneer is made of and place it in an earthen pot, pour boiling water over it and stir it well. Then let it stand for a week or ten days, occasionally stirring it, at the end of which time let it boil until it assumes the condition of a pulp. Then put it in a coarse cloth or bag and squeeze it to expel the water.

Keep this on hand, and when needed mix some of it with thin glue, to make a paste; rub this well into the checks. When it becomes dry and hard clean off with sandpaper. If this is properly done it will be very difficult to discover traces of cracks or checks.

Why the Varnish Sweats.—There are several things that will cause it. Sometimes the filler has not been allowed time enough to dry and will sweat through the varnish coat. Then insufficient time between coats of varnish will cause it. Where three coats of varnish are given some finishers allow a longer time between the second and third coats than between the first and second. That is a mistake. Longer time should be allowed between the first and second coats than is necessary between the second and third coats. Most plants allow their filled work to stand as long as possible. But the varnish coats should not suffer in the making up of this time by rushing the work. The filling should have at least forty-eight hours, and one-third longer would be still better. If it is the right kind of filler it will give good results with that amount of time for drying. The coat of varnish on the filling should have ample time to dry, for it will shrink some, and hence should have time enough to do its shrinking before the next coat is applied.

Making and Using the Tacky Rag.—This is a device intended to follow the dust brush, and it is made as follows: Mix together one gallon of varnish, one pint of turpentine, and one gill of raw linseed oil. Take a piece of cheese-cloth and wet it in this mixture, then wring it out dry with the hands, after which spread it out until it becomes tacky enough to use without danger of its smearing the work. This rag will gather up all dust, etc., left by the duster. The oil prevents the mixture from becoming dry, while the turpentine reduces the varnish so that it will not

become gummy. When the rag becomes dirty discard it for a new one.

Ebonizing Piano Keys.—The idea is to stain the wood through, and the only way this can be done, we believe, is by boiling or steaming. Extract of logwood and bichromate of potash offer the best stains for the ebony, if the wood is birch, for it seems that it does not prove satisfactory on any other wood. Hard maple will polish better than birch, and is perhaps a more desirable wood for making the piano keys than birch, but for some reason it does not take the stain well.

But let it be observed here that it will not do to place the dry wood at once into boiling water, for that seals up the outer pores and thus prevents penetration. First soak the keys in cold water for several hours before placing them in the hot stain; by doing this they will take the stain better and there will be less spoiled through splitting.

Polish for Ebony.—Add a small quantity of powdered Prussian blue to white shellac; this will enhance the black effect.

Removing Dust before Varnishing.—The tacky rag has been described. Another device, very ancient, too, is the duster brush with a little raw oil rubbed on the tips of the bristles, with which go over the work several times. By rubbing the bristles over the hand several times they will generate and hold electricity enough to pick up the dust when the brush is dry.

Staining Brown Mahogany.—A good shade of brown mahogany may be made with brown mahogany powder, the same as is usually mixed with red for ordinary mahogany. And the walnut crystals should give satisfaction. This gives a beautiful shade of brown. Brown mahogany is usually filled with black

filler, bodied up in the usual manner, and rubbed to a dull finish. Here is another formula: Dissolve five drams of an oil scarlet, oil orange, and oil black, placing each in a separate vessel, with a pint of benzol in each. Perhaps an extra dram should be allowed of the black. With these three standard solutions almost any shade of oil mahogany can be produced. Adding the orange to the black gives a brown, and the addition of red gives various shades.

Perfume for Renovators, Etc.—Most furniture polishes and renovators have an unpleasant odor, and to hide it certain essential oils are added to it, oil of mirbane being the most commonly used. It is the essential oil of bitter almonds and is a cheap product. There are several pleasant-smelling oils that might be used, but they are too costly. Oil of wintergreen is nice, while such oils as that of origanum, thyme, etc., may be used. Lemon oil is another one that is sometimes used in polishes, or in renovators, as in addition to an agreeable perfume it has the quality of cleansing a dirty varnished surface, as many of the essential oils do, but it is costly. When used with rubbing oil it quickens the rubbing process about one-third, it is said. But if used in this way the work should afterwards be well cleaned off; if rubbed with a pad on a varnished surface it will dull the varnish, like curled hair.

Hardening Varnish for Table Tops.—The German method is to add a small amount of alcohol to the varnish intended for table tops, to harden it, while at the same time it does not impair the elasticity of the varnish; it does, however, dim the varnish, but this effect finally wears away.

Solubility of Varnish Gums.—The gums used in making varnishes are soluble in oil under heat as follows: Kauri copal, 509 deg. Fahr.; Manila, 468 deg.

Fahr.; North Coast, 548 deg. Fahr.; Zanzibar, 156 deg. Fahr.; Benguela, 507 deg. Fahr.; Sierra Leone, 460 deg. Fahr.; Angola, 539 deg. Fahr.; Brazilian, 453 deg. Fahr.; Damar, 314 deg. Fahr.; Mastic, 313 deg. Fahr.; Asphaltum, 349 deg. Fahr.

Covering Capacity of Varnish.—It is estimated that one gallon of shellac varnish will cover, on smooth pine, first coat, 400 square feet; and 500 square feet on succeeding coats. Copal varnish will cover 350 to 400 square feet first coat, smooth pine, 500 square feet second coat, and nearly 600 square feet on third coat. Copal varnish will cover 50 to 75 square feet more on filled than on unfilled wood.

Finishing Laboratory Table Top.—Owing to the fact that glass vessels and other breakable objects are used in the laboratory it is not expedient to have marble, slate, glass, or other hard substance for the laboratory table top. Only wood is available, but wood becomes very dirty and unsightly from the spilling of the chemicals upon it, rendering frequent renovation necessary. Here are some practical formulas for rendering a wooden table top immune from the action of the chemicals:

Solution No. 1—
- Copper sulphate ..... 50 grams
- Potassium chlorate ..... 40 grams
- Water, q. s..... 500 c. c.

Solution No. 2—
- Aniline hydrochloride ..... 50 grams
- Ammonium chloride ..... 40 grams
- Water, q. s..... 500 c. c.

Solution No. 3—
- Potassium bichromate ..... 50 grams
- Water, q. s..... 500 c. c.

Solution No. 4—
- Sodium sulphite ..... 80 grams
- Sulphuric acid ..... 20 c. c.
- Water, q. s..... 500 c. c.

Solution No. 5—
- Soap suds .....

These solutions are to be applied in the following order: Nos. 1, 2, 1, 2, 3, 4, 3, 4, and 5. Be sure that one coat is dry before applying the next. This is very important. Apply the liquids with a bristle brush, as you would a water stain, allowing the wood to absorb all that it can, which will make the work more durable and attractive. The soapsuds "fix" or set the color, which is intensified by the sulphuric acid. After the soap solution is dry the surface is rubbed with vaseline, which gives a soft and pleasing finish, besides being water-repellent. A great deal of hard rubbing is required on each coat. The color at the finish is a rich dark brown.

Formula No. 2.—The surface of the table top should be treated with a solution of copper sulphate one part, potassium chlorate one part, dissolved in eight parts of water, made boiling hot. Apply this solution to the wood and let it soak in. When dry apply a coat of the following solution: Aniline hydrochlorate three parts, water twenty parts. Two coats of each solution, alternately. When dry apply a full coat of raw linseed oil, rubbing it well into the wood, using a woolen cloth for the purpose; after which wipe off surplus oil and wipe dry. The color will be ebony black. The table top may be kept in good condition by washing off now and then with weak soapsuds, allowing this to dry, then rubbing with linseed oil.

Formula No. 3.—This formula assumes that the acid solutions are not necessary, as it is the vaseline finish that makes it water and acid proof. You can take your choice. Take eight ounces of iron sulphate, two pounds of logwood extract, three ounces of nutgalls, two ounces of Chinese blue, and four ounces of iron carbonate, boil in one gallon of strong vinegar for two or three hours. When cooled strain and apply, either hot or cold. If one application does not

give a jet black on becoming dry give it a second coat. For quicker results dissolve extract of logwood in only enough to answer the purpose, or until you get the desired strength, then strain and apply. By going over this with a tincture of muriate of iron the color may be developed to any depth. Finally, sandpaper smooth, and then apply the vaseline.

An expert, speaking on this subject, says the acid treatment is merely to darken the wood, and that it has no real value as to the wear of the table tops. We favor the first formula, mainly because we have seen it worked out satisfactorily. It probably is not true that the acids and rubbing together have no other effect than darkening and polishing the wood. In process No. 1 each coat of stain, etc., was rubbed vigorously and long into the wood, especially the soap solution; the vaseline gave the desired polish, but certainly was not the chief protecting agent.

French Artificial Wax.—Melt together one hundred parts of paraffin wax, fifty parts of clear pale rosin, and one part of carnauba wax. Then mix five parts of talc and enough yellow aniline or powdered curcuma to give it the yellow beeswax color. Stir the mass until it is cold.

Chamois or Goat Skin.—Chamois skins are mostly the skins of young goats or kids. The chamois skin is heavier than that from the sheep, and also coarser. For strength and durability the chamois skin is to be preferred, but for ordinary use the oil-tanned sheep skin does very well and is much cheaper. The tanning is done in about the same manner as with the chamois skin.

Concerning Sponges.—The sponge is an animal. Deep water sponges are best. Good sponges come from Nassau and Cuba, but most of them come from a reef off the Florida coast. The sponge fishers fill the

sponges with sand to make them heavier, as they are sold by weight. Bleaching makes a sponge look nicer, but it injures it. A trick is to pack a certain portion of inferior sponges with the best grade, the lot being then sold as first grade. You cannot tell by looking at a sponge whether it is loaded or not. The only way to do is to buy from a reputable firm. Keep the sponges in a rather damp place when not in use. Sponges should be used within a year after being taken out of the water. A weak solution of ammonia will cleanse a dirty sponge and do it no harm; it acts also as a bleach. Or a strong solution of sal soda will do as well as ammonia.

Testing Turpentine.—There is adulterated turpentine and turpentine substitutes. Turpentine made by synthesis, also by admixtures of mineral oils. When you undertake to thin varnish with turpentine you should know whether the same is genuine or false. A mixture of both turpentine and benzine is a bad thing to put into varnish, for they will not mix, no more than oil and water.

By placing a little turpentine in a saucer in the sun you can tell whether it is good or bad. If genuine it will evaporate completely in two or three hours at most. Place some on a sheet of white paper; if pure it will soon evaporate and leave no stain. Weigh a sample of suspected turpentine and compare its weight with that of standard pure turpentine. The pure is the lighter of the two.

China Wood Oil.—This oil has been in use for several years in connection with varnishes, but mostly in the cheaper grades, rosin being largely used in them. Such varnishes are made for cheap furniture and interior work, also for dipping.

The formula for making a durable cheap furniture varnish in which China oil figures is as follows:

Melt 120 lbs. of rosin to 500 deg. Fahr. and add 4 lbs. oxide of calcium; then add 12 gals. of China wood oil, and run the heat up to 600 deg. Fahr., cooling to 350 deg., then adding 6 lbs. of powdered litharge; heat now to 575 deg., and finally cool off to 325 deg. Then thin with 30 gals. of naphtha.

Experts say that China wood oil cannot be heated by itself to a higher temperature than 450 deg. Fahr. without danger of gelatinizing, or becoming a mass of jelly insoluble in all but the costliest liquids. This is said to occur even in conjunction with other substances in varnish making. If more oil is wanted a boiled linseed oil must be used, one having three pounds of borate of manganese to the fifty gallons of oil, and this may be used in equal proportions with China oil.

It seems that this oil has a fatty content, and that it is this that causes varnish containing it to flat out on exterior work. Paint makers who have used it in making enamels say that the paints become fatty in the cans. Used with lead paint it causes the paint to "liver" or thicken, due to the chemical action of the lead, or excess of alkali on the wood oil and rosin.

Brush Preservation.—Once a brush has been put in good varnish and on good work keep it there and keep it clean. When placed in a keeper have the liquid in which it is kept come well up over the bristles, so that none of the varnish may dry in the butt of the brush; keep the keeper in a closet and keep it clean. There is difference of opinion among workmen as to what is the best liquid for keeping the brush in when not in use. Many prefer to keep it in the varnish in which it is used. This saves time and labor when taking out the brush to use. But if he uses the brush in various varnishes it will not matter what it is kept in as regards the kind of varnish. Raw linseed oil is

a good medium, but it will have to be thoroughly worked out of the brush before putting it into the varnish. Some use a mixture of oil and turpentine, but this mixture also will have to be worked out before putting the brush into the varnish.

A brush should be kept in a tightly closed keeper with the brush suspended so that the bristles will not touch the bottom of the container. Whatever the liquid in the keeper, be careful to clean out the brush before putting it into the varnish that you are going to use; if in oil, then wash it out in turpentine, then work it well into some of the varnish you are going to use, and don't put this varnish back into that from which it was taken. A little oil or turpentine in the brush working out on to your job will cause lots of trouble to you. None of this varnish need be wasted; keep it in a can and use on some common work. We would suggest keeping the brushes in varnish thinned a little with turpentine, and changing the same at certain intervals, using the old varnish from the keeper as suggested above.

All new brushes contain more or less dirt, and this should be shaken out before the brush is put in the varnish. After shaking out loose bristles and dirt, wash it in some turpentine or benzine, and then work it in some clean varnish and use the brush on medium work before using it on first class.

Finishers' Supplies Described. — Sandpaper comes in sizes 00, 1, 2, 2½, and 3. Pulverized pumice-stone, FFF, or Extra Fine; FF, F, Fine; 0, or Usual; 1, Coarse; ½, Grain, Rottenstone, powdered. Steel wool, 0, Fine; 1, Medium; 2, Medium coarse; 3, Coarse; Shavings, Fine; Shavings, Medium; Shavings, Coarse. Rubbing Felt in sheets 18x18, but cut to any desired size; Hard Mexican, one-quarter inch and one-half inch thick; Soft Mexican, same thickness

as hard; and Soft Spanish, same as Soft Mexican. Rubber pads may be bought but are easily prepared.

The Waxes.—The waxes used in making furniture polishes and floor waxes are as follows: Beeswax, white and yellow; Carnauba wax occurs in thin films on the leaves of a palm growing abundantly in Brazil; it is very hard and brittle, of a grayish color, and melts at from 180 to 185 deg. Fahr. It is used with ceresin or beeswax for floor polishes; Ceresin is the refined form of Ozokerite or mineral wax found in nature, and it can be had in yellow color or white. It resembles paraffin wax to some extent, but is less scaly. It has driven beeswax and paraffin wax out of furniture and floor polish manufacture to quite an extent. Its melting point varies somewhat, but is near that of beeswax, or usually from 135 to 140 deg. Fahr.

Testing Varnish.—To test varnish for drying hard without thickness try it on a sheet of glass, at a temperature not lower than 53 deg. nor higher than 68 deg. At the end of twenty-four hours partly cover the varnish with a wet cloth, using clear cold water. Examine after eighteen hours. The damp part will show alteration, but the surface should resume its former luster and general appearance in six hours.

Floor varnish properly applied to a well prepared surface of wood or glass should dry dust-free in from six to eight hours at 53 deg., in daylight, ceasing to be tacky at the end of ten or twelve hours, and quite hard in twenty-four to thirty hours. It should stand rubbing with the dry finger at the end of twenty-four hours, and take a smooth polish with pumicestone and water without softening or tearing. It should also stand the wet cloth test, and after drying for twenty-four hours at 53 deg. the varnish should have the same gloss as the same or similar varnish applied side by same on the same surface.

Good varnish works easy under the brush, flows out well, levels up perfectly, has good luster, has fullness and does not die away, sets free from dust in a reasonable time, and finally becomes hard enough to resist a certain amount of friction.

A good test for varnish consists in coating a sheet of glass and when allowed a proper time for drying submerging it in water. If the varnish shows white on its surface it is poor. But it must be remembered that nearly all long-oil varnishes will show white sooner than short-oil varnishes, because they contain more oil than the latter and less hard gum. Fine carriage finishing varnishes show mud-spotting worse than the other varnishes used because "long-oil" varnishes.

The drying is one of the most important tests for varnish. Applied to wood, glass or metal it should in twenty-four hours have dried sufficiently to have thorough adhesion, and must within the ensuing twenty-four hours have entirely dried away, without, however, losing a certain elasticity and softness. If it dries more quickly no defect is thereby indicated, but if it dries more slowly it is evident that it was not sufficiently boiled, that an insufficient quantity of driers was added during the boiling process, or that it contains some foreign matter.

Varnish should be tested to ascertain its drying properties and relative durability.

A simple test for brittleness is to allow a drop of the varnish to trickle on to a narrow piece of glass. Note the time required to dry, and when dry see if the varnish can be removed readily by the thumb nail. If too brittle it will easily cleave from the glass, in which case it is of no value for finishing coats.

Outside varnishes should be tested by application to

pieces of hard wood, previously filled, and should then be placed in an exposed position for two years.

Some varnishes seem to have the property of rapidly darkening the surface to which they are applied, especially on grained work. It is well to make tests of various kinds of varnish on painted and grained panels and note if this peculiarity exists.

Price is one pretty fair test for a varnish. If offered a pale varnish at a rather low price it is reasonable to assume that it was not made from high-grade varnish gum.

It requires only a short time to ascertain the drying or hardening qualities of a varnish, but it will take months to get a fair idea of its wearing qualities. Varnishes are usually valued for their transparency, gloss, drying and working qualities, but more so for their wearing quality and clearness. To ascertain by comparison the relative value of varnish the color should be considered, the pale ones being of the most value, as the darker ones are liable to darken the ground, and in cases as the finishing of light natural woods this is most undesirable. It should work freely and flow out evenly, and after several months' exposure should not crack, powder, chip or rub off.

To ascertain in some measure the quality of the varnish take a large pane of clean glass, drop a little of each of the varnishes to be tried at one end of the glass, side by side, then set the glass in an inclined position. Then observe carefully the varnishes as they flow down over the surface of the glass to the lower edge, note the setting and drying of each, also examine the film, whether it be wavy or smooth. Smoothness will show the varnish to be well made, while a waviness shows it to be too thick, or poorly made. If the varnish drips freely from the edge it indicates that it

has been made from good copal gum. If the drip shows a tardiness or a tendency to draw back it shows the presence of rosin.

Or apply the varnishes on a dead black flat surface; when dry expose them to the sun. A varnish containing rosin will, in a few weeks, show it by silking and alligatoring.

A good varnish for architectural purposes may be known by these indications: Absence of much color; constancy of consistency; characteristic odor, in which turpentine predominates; ease of flowing under the brush; free flowing or running; will not easily show brush marks; dries rather quickly, though not unduly so; retains its elasticity and suppleness and will never be sticky; stands exposure to the weather and all ordinary wear and tear.

A low-grade varnish dries very quickly, though some kinds will become soft after a time succeeding the drying, remaining soft and sticky indefinitely; dries hard but never is supple and elastic; shows white under the water test; scratches under the finger-nail test; difficult to apply, setting quickly, in some cases setting as soon as applied; rank odor, benzine predominating; brilliant luster, but subject to cracking badly.

Now and then we come across some very light-colored copal varnish, sometimes called white copal varnish, or that made from the lightest bits of copal gum, yet we are suspicious that it gets its whiteness from damar gum. There is a simple test for this: To one part of the varnish add two or three parts of rectified sulphuric ether. If the mixture remains as clear as water the copal is pure; but if a milky turbidity follows it is adulterated either with gum damar or damar varnish.

Preventing Filler from Caking.—To keep the paste filler from settling or caking after thinning with

turpentine, benzine or substitute turpentine it is not necessary to use an emulsion, as cornstarch will do; not more than 20 per cent. of the weight of the silex used, and 10 per cent. is usually enough. Use bone-dry starch of best grade. Asbestine powder, 25 per cent., will do, though it is not quite as effective as starch, but it is cheaper.

Baking Varnish on Wood.—The present status of the varnish industry does not admit of the baking of varnishes on the general run of wood furniture at a temperature above 120 deg. Fahr.; and that only where the humidity is automatically controlled. In tests made to determine what saving could be made in baking varnishes for aeroplanes it was found that five to six hours, at 110 deg. Fahr., was the highest temperature and shortest time that could be used for varnishes that met the Government specifications. With a short-oil rubbing varnish the time might be shortened, but the temperature could not be increased.

Crackle Finish.—This finish is intended to simulate varnished work that has become fissured or "crackled" through extreme age. Three methods are here given. One way is to finish the work in the usual manner, and then, before the varnish is quite dry enough to rub, say, forty-eight hours, unless it be a quick-drying varnish, apply a coat of shellac, though it must be applied thin, about one pound of gum to the gallon of alcohol. It will likely take several days for the desired crackle to appear. Another way is to apply a light coat of shellac and scratch lines through it with a very fine point; then revarnish with light coat of varnish.

Another method: After the object has been filled or stained, or both, apply a coat of shellac, and when this is dry place spots of boiled oil on the surface, here and there, these being left to dry as they will, and of

course they do not become dry, but rather soft. Then apply a coat of varnish, and in time the varnish will crack over the oil spots, on account of unequal contraction, and that is the crackle finish.

Finishing Mahoganized Birch.—Many finishers are not filling their mahoganized birch but are putting on two coats of shellac instead, putting on the first coat very heavy and brushing it well into the wood, then they are at a loss to know why their finish is dark and lacks the clear transparency that reveals to view all the finer markings of the figure. To draw out and preserve all the details of the figure, birch should be filled, and if an extra-fine finish is desired, it is well to apply a wash coat of shellac and sand before filling. Much mahoganized birch that shows a plain surface and indistinct figure would be made beautiful by being filled with a dark filler to make the pores show up and increase the striking features of the grain.

Finishing Birch Veneers.—Well-made rotary-cut birch veneer makes a splendid face veneer for large panels, and if finished correctly presents a modest though strikingly beautiful figure. This wood is worthy of considerable care in finishing. A good way to finish it is as follows: It should be first sponged before it receives its final sandpapering in the cabinet room, and on reaching the finishing room give it a coat of stain a little lighter in color than the depth desired for the final finish. This will raise the grain somewhat. After the stain has thoroughly dried out it should be sandpapered with sharp, fine sandpaper to remove this raised grain, after which coat it with the full-colored stain.

To more thoroughly draw out the figure of birch, fill it with a dark filler to make a dark pore. Birch that has been water-stained should always be filled to avoid pinholes, although the filler need not be as heavy as

for some of the more porous woods, such as walnut and mahogany. After the wood has been filled and given time to dry, body up in the usual way for either dull or polished finish.

Oxalic Acid Preparation.—Oxalic acid intended for bleaching purpose may be prepared in the following manner: Dissolve about one pound of the acid in hot or warm water, and apply it hot if possible, for in that condition it acts more quickly. The solution may be kept on hand by placing it in a glass or porcelain-lined vessel, well stoppered and labeled, as it is a rank poison. The addition of strong vinegar or acetic acid makes the bleach more effective, and somewhat less poisonous.

Non-Cracking Linseed Oil.—A very elastic oil may be prepared by the addition of rubber, whence its name, rubberoil. It is intended for paint used on exposed surfaces that are subject to more than ordinary expansion and contraction. Procure pure Para rubber and shred it with a sharp knife; this must be done by cutting it under water, to facilitate the cutting. Dissolve three pounds of the shredded rubber in eight gallons of turpentine with a gentle heat in a pan, and when solution is complete add two gallons of boiled linseed oil, warmed to a temperature of 100 deg. Fahr., and mix well. Strain while warm and keep in a warm place. Do not do this work near an open fire; a hot water bath is better, though the factory would use a "jacket pan."

Figureless Quartered Oak.—The call to-day is for quartered oak having no figure. This arises from the popularity of the greenish-gray finish seen in architectural work, and to almost the same extent in furniture. The idea is to get what occurs normally, only through the lapse of time, with bare oak. It is a sort of gray weathering, or greenish-gray, as stated.

High Polish on Red Cedar.—This is applicable to the finishing of red cedar chests, answering a question. Give the chest a coat of hot linseed oil, and after twenty-four hours apply a coat of shellac. Either white or orange shellac may be used, being governed in the selection by the shade of color one desires the finished article to be. When the shellac is thoroughly dry apply a coat of varnish, after first sanding the shellac smooth with very fine sandpaper. If a fine finish is desired, put on a second coat of varnish when the first coat is dry enough to permit. When the last coat of varnish is thoroughly dry, rub to a smooth surface with pumicestone and water, using finely ground pumicestone for the purpose. Allow it to stand for twenty-four hours and then rub it with rottenstone and water. After a few hours, polish it in the usual way.

Finishing Birdseye Maple.—All dark streaks must be bleached out. If any eyes have fallen out the holes must be filled with putty made from fine maple sawdust and glue size, making a stiff paste. Set the job away until the paste filled holes are dry. If holes appear after you have started finishing use shellac instead of glue in making paste filler. A little shellac in the hole before filling will be better. Use white shellac or white glue, as the case may require.

First-coat with white shellac, and body up with white Damar or other quite pale varnish. This wood does not need to be heavily coated to get a good finish. If to be rubbed dull only enough varnish to stand rubbing is needed; rub with oil and powdered pumicestone. If to be polished, then a heavier body of varnish will be required.

Wax Finishing Small Articles.—The way that axe handles and many other small objects are polished with wax is by placing them in a revolving machine

known as a tumbler, with shredded paraffin wax, mixed with shavings, thrown in.

FINISHING OUIJA BOARDS.—One woodworker made 40,000 of these boards last year. They are made of three-ply material. A high finish is required, so that they may slide easily. It is a tedious process, sandpapering and rubbing each one by hand, so that the following method, the invention of a handy finisher, shows how to do the work more expeditiously and cheaper. He made a little machine like a vertical belt sander, having a cotton belt in place of the sandpaper. He applied a little oil and rottenstone powder to this belt, and then worked the boards against it, getting a smooth, highly polished surface in a few seconds. As many boards were done in an hour on the machine as were done by hand in an entire day.

OILED SANDPAPER.—To sandpaper varnish without scratching it soak the sandpaper with raw linseed oil; mineral oil will not do. Whether oil on the surface of the work, using a dry sandpaper, would give the same result can be determined by trial.

RUBBED VS. VARNISHED SURFACES.—At this writing the dull finish has the call; but the public are not wise to their own interests. The dull-rubbed finish will not protect an article as well as the one finished in gloss. You never see a piano in dull or rubbed finish. This because it is desirable to protect the finish with a better medium than rubbed varnish.

BIRDSEYE MAPLE.—Birdseye maple veneers should be laid face down, for if laid the other way they will have their eyes scratched out before getting to the finishing room. This is the statement made by an expert woodworker having twenty-eight years' experience.

POLISHED END WOOD.—Sometimes there comes

from the woodworker a piece of furniture that has ends of wood so highly polished that stain will not take on it; it is caused by the sandpaper man's paper being too smooth, and in order to make it cut he puts on extra pressure that almost burns the wood. You can remove the gloss with a piece of medium fine sandpaper.

All-Around Varnish.—Varnish makers are putting on the market a varnish that they say is good for all varnish purposes; don't believe it. No one varnish is suitable for all purposes.

Making Brown Mahogany.—Don't get it too dark. Let the stain be light enough to produce a clear, transparent color. Prepare the stain by dissolving walnut crystals in water of about 150 deg. Fahr. If the water is too near the boiling point it will likely melt the crystals into a gummy mass, and dissolution will be very slow. Place the crystals in the hot water and stir well until they are dissolved. Use the stain cold. The usual method of making a stain is to pour the water on the stain. But not so with walnut crystals. There is a shade of brown mahogany on the market that has met with much favor. It is rather duller than that produced by walnut crystals, but for that reason seems to be the more admired. And it is more difficult to make. First dissolve six ounces of bichromate of potash in six quarts of water. Coat the wood with this and allow it to stand until dry. Then take eight ounces of English oak powder, five ounces of brown mahogany powder, and two and one-half ounces of jet black Nigrosine. Dissolve these in six quarts of water, and after sandpapering the wood with fine paper to remove any fuzz raised by the first stain, put on a good, even coat.

Humidity in Finishing Room.—While excessive moisture in the finishing room is to be avoided there

must be a certain amount of humidity present. To obtain this set a number of pails around the room, filled with water. An automatic process follows; as the temperature of the room rises and the air begins to dry out in consequence, there will be increased evaporation of the water in the pails to maintain humidity. When temperature falls evaporation gradually decreases. In a temperature of 80 deg. Fahr., with a high humidity, evaporation will be slow; but in the same temperature, with a low humidity, the evaporation will be comparatively fast.

Toning Down Circassian.—Fashion at this time demands quiet figures in woods. The strong contrasting figuring of Circassian can be toned down with light walnut stain. This will not destroy the finer markings nor darken the color too much. The only parts that will be affected by the stain will be the real light ones. These parts should have a coat of stain and let dry. Then the whole surface should be stained. This will produce a uniform coloring and eliminate the too striking effects objected to. Use a water stain, made from any walnut powder (brown) or walnut crystals. After drying sandpaper the wood lightly with very fine paper before filling.

Staining Mahogany.—Notwithstanding the fact that to the admirer of the natural color of wood, which grows richer and deeper with age, such woods as mahogany and walnut make their strongest appeal in natural form, practically all of the mahogany used in the cabinet world to-day is stained. Moreover, sometimes it is stained until one is able to recognize the wood only through its figure and grain, the color being so altered as to not materially resemble the natural color of mahogany. Sometimes it is darkened to a fair resemblance of the natural color of black walnut, while at other times it is given a strong green tint. These ex-

tremes are extremely objectionable. They run as fads through the various seasons, for short periods, mainly. Properly, mahogany is stained to deepen and bring out artificially in a short time the natural beauty of the wood which develops in the course of years.

Finishing Inside of Case Goods.—It used to be the practice in former years to finish the inside of furniture a lighter shade than the outside, but now the general way is to employ a special bright color, as a rich golden color for the medium and light shades of brown mahogany, which makes a striking contrast and a perfect harmony of color. To make this particular finish dissolve one ounce of oil yellow in one quart of brown japan, and when dissolved reduce it with turpentine to the desired shade. Heat will hasten the dissolution of oil yellow, though the stuff must not be placed over a fire; the hot water bath is best. Stir frequently, then strain it to remove sediment. This stain will stand considerable reducing, and should be used just strong enough to tint the wood the desired golden hue. It shows to the best advantage where the inside has been mahogany veneered, although it looks well on birch or any white wood. The shade may be varied by the addition of oil brown, to be dissolved in the same way as yellow, and added in the liquid form.

Another drawer finish is made as follows: First apply a coat of heavy orange shellac; when dry sandpaper well and give a coat of the following preparation: Dissolve four ounces of powdered borax in one gallon of hot water and, while the preparation is still hot, stir into it four pounds of orange shellac. Pour the shellac in slowly and stir constantly until thoroughly dissolved. Do not use until cold, and do not brush enough to make a foam. When applied over a coat of spirit shellac this preparation gives a smooth, satin-like finish. It is not as water-proof as oil var-

nish, therefore if the job is to be water-rubbed it ought not be put on until after the rubbing has been done.

A dull finish, made without rubbing, may be made by the following formula: Heat one gallon of water to almost the boiling point, then drop in six and one-half ounces of powdered borax, and stir until the latter is thoroughly dissolved. Pour slowly into this liquid three pounds of orange shellac gum, stirring constantly until the gum is dissolved.

To make the beautiful dull finish that is such a distinguishing feature of the inside of some high-grade furniture that is on the market, a reasonable amount of care must be used to put the wood in shape to receive the finish. If the drawer bottoms are three-ply, with a porous veneer on the face, the bottom should be filled before it is put in the frame. Filling first saves a lot of work. When this is done there are no corners to pick out, and the filler can be put on and removed much more easily. When the filler is dry the whole should be coated with spirit shellac, putting on a good heavy coat. Sand this coat nice and smooth, and, after dusting off clean, coat with the dull finish as given above. A good coat of this finishing should be applied with as little brushing as possible. It will not show laps or streaks when dry, so that a slight run or sag will do no harm. The main thing to avoid is froth, which will come from too much brushing.

If an extra good job is desired, put on two coats of the spirit shellac, and sand before putting on the finish. Remember the borax-shellac composition is a "finish," and ought not to be used except for that purpose. With a well-prepared foundation of one or two coats of spirit shellac or other quick-drying surfacer that sands nicely, this "finish" will produce a surface that is beautifully dull and as soft and pleasing to the touch as a piece of satin. Use the finish cold.

The inside of all case goods should be finished considerably lighter in color than the outside in order to relieve the monotony of color; and create a pleasing and harmonious contrast. This gives the inside that distinctive and chaste appearance which is so attractive to the cultured eye; and which at once stamps the goods, in the opinion of cultured people, with the earmark of quality. In the case of mahogany goods, the same stain that is used on the outside and allowed to dry as it is put on, may be used on the inside, but wiped off before it becomes dry. This will produce a lighter shade of the same color as the outside.

The inside of a cabinet should never be finished in a gloss; to do so is to stamp it with the seal of cheapness, no matter how good everything else may be. Far better to merely put on a coat of shellac, sand and wipe it off, than to put on a coat of gloss varnish and leave it in that condition. A coat of shellac over the stain, and when dry sanded and a coat of dull varnish applied, will give the inside the rich, clean appearance that appeals to people of quality.

If an article is faced with a fancy mahogany veneer and the inside is a plain mahogany, the stain used on the inside should not be more than 25 per cent. as dark as the outside. If the inside is birch a darker stain may be used, but should not be more than 50 per cent. as dark as the stain used on the face. The idea should be to make the inside look as much like the wood one hopes to imitate as possible, and at the same time preserve that harmonizing contrast that is such a pleasing and distinguishing feature of certain classes and makes of goods. The same thing applies to walnut and all other woods.

The inside of an article should never be finished with a gloss if a pleasing effect is desired. No matter whether the outside is dull or polished, the inside should

always be dull finish. It will help greatly in producing a smooth finish if an oil stain is used on the inside; this will not raise the grain and will eliminate the necessity of sandpapering between coats of finish if care is taken to keep them clean. A coat of shellac and a coat of flat varnish will produce a good interior finish. If a spirit shellac is used it should be sandpapered.

To make a nice finish on plywood drawer bottoms they should be filled before they go into the drawers. If a water stain is used on the drawers it may be applied over the filler and then wiped off with a cloth. This will usually make it dark enough to match the sides. But for inside work I would recommend oil stain as more satisfactory. On this inside work there is not the same objection on the ground of fading as there is when used on the outside, for the reason that the fading is caused by light, which does not reach the drawers to the same extent as the outside. The oil stain does not raise the grain of the wood, which insures a smooth job with less work. One difficulty about an oil stain on drawers is that of first-coating with a varnish surfacer, which moves the stain, while some object to the use of shellac for this work because of its present high cost. But the difference in the amount of labor involved, between an oil and a water stain, in preparing this work for the final coat of finish, is sufficiently in favor of the oil stain to more than compensate for the extra cost of the shellac.

The Curly Woods.—The beauty of figure derived from certain woods with what is known as a curly growth has long been recognized in connection with certain well-known cabinet woods, but of late years the list of woods producing a desirable curly figure has been materially lengthened. Back in the older days we knew and appreciated curly walnut, mahogany, maple and ash, but of later years we have added to these the

recognition of many other woods, including birch, beech, sycamore, oak, poplar, magnolia, gum, pine and fir. Perhaps there are a few other woods that have had local recognition, but this list will give an idea of the wide range of woods in which the curly growth in the tree may result in a beautiful figure effect for face work.

The lighter woods, like magnolia, poplar and gum, have been used in the past more for staining to get effects than any other way. Indeed, there has perhaps been too much staining in imitation of other woods and not enough effort to develop the natural beauty of the curly figure. Maple is a sort of exception in this. This wood has always been appreciated for its natural creamy white beauty, and the curly maple, like the birdseye, has suffered less from excessive staining than any other of the light woods.

In times gone by the idea in staining curly woods seems to have been that of getting a bright color on them. Beech, sycamore and birch were stained in imitation of mahogany, or at least given a reddish color, and the high coloring was sometimes used on poplar also. To-day the tendency to color with stain is more pleasing because it runs to brown tones, to walnut-like colors, which is much more satisfactory than the more striking color stains of bygone days. What we really need to do with our curly woods, however, is to make more effort toward developing their natural beauty and to use only such stains as will bring out and emphasize and not obscure.

In the resinous woods we have enough striking figure, anyway. Take yellow pine from the south or fir from the west, and when we strike a curly growth the figure and color are striking enough within themselves, without any stain effects other than such as will temper or harmonize the different parts. Of course, we have

enough natural color in walnut, mahogany and oak, and these are seldom stained except to conform to certain peculiar shadings that may be in popular favor at the time.

In many of the other woods, such as birch, beech and sycamore, as well as poplar and magnolia, which is really a kindred line, there may well be more effort toward developing what natural beauty tones these woods possess, just as we have with curly maple in the past, for nearly every one of our cabinet woods has a beauty in itself that should be recognized and utilized wherever practical.

How Sandpaper is Made.—The paper is made from Manila fiber, mostly old ropes, hence its very tough nature. The sand is either crushed flint or garnet. The crushed flint or garnet is sifted in several sizes, to suit the various degrees of fineness of sandpaper. Hardness and sharpness are the prime requisites. Obviously, sand, while hard enough, has no cutting edges. Garnet is a better abrasive than flint, but it is very much more costly, though more desirable where very hard surfaces are to be reduced. Evenness of the sand on the paper is also requisite, and this is done to an exact degree. This grit is sifted evenly down onto a roll of paper that has been glued by revolving rolls just before the sand falls, and the whole process is done automatically by machinery.

Sandpaper ranges from that which is soft like velvet—No. 000, on to No. 4, which resembles a section of turnpike—and not a smooth pike either. The smooth papers run from 000 to No. ½. After those come Nos. 1, 1½, 2, the most generally used; all after those numbers, 2½, 3, 3½, and 4, are the coarse ones. Each has its purpose.

To test sandpaper for quality rub two sanded sides together; if the sand comes off easily it is poor stock.

Good sandpaper is tough and elastic, the sand holds well, the sand is evenly sifted on, and it cuts clean and fast.

How to Use Sandpaper.—To prevent the paper from slipping under the hand chalk its back. When sanding around the edges of an object be careful not to cut through; bear on with a firm but gentle pressure. To avoid dust wet the paper with benzine or turpentine. This will also cause the paper to cut faster. Keep the paper in a dry place. For certain difficult places split the paper. There is sandpaper sanded on both sides and made easy to split.

VARNISH STAINS

STAINED varnishes are put out by manufacturers for household consumption, though considerable amounts are being used by painters for doing cheap grades of building work. Many of these stains are of excellent quality, but for the most part inferior varnishes are employed in their making, the idea being to produce a finish having a very high gloss and attractive coloring. Such finishes may be made by simply staining oil or spirit varnish with aniline dye. Where a brittle varnish is used it may be improved by the addition of a little gum elemi or Venice turpentine. The latter is perhaps the best of the two. Gum elemi is apt to retard the drying of the varnish, even when used in small amount, while excess will cause stickiness. If used at all it will be safer to use a very little.

There are stained liquid fillers, and these may be included with varnish stains; it is very quick-setting and brittle; it is also lacking in easy working quality, which is so essential to good surfacing, and spreading and blending. It is used mainly on soft woods, on cheap work. Being a copal varnish, presumably (it may and usually does contain some rosin), any oil ground pigment will mix with it. To retard too rapid setting or drying add a few drops of raw oil; this will also make it flow easier.

Stained filler should be used thinner than that which contains no stain, so as to give a more uniform coloring and covering and no laps.

WALNUT VARNISH STAIN.—Dry burnt turkey umber four and one-half pounds; raw linseed oil two

quarts; furniture varnish one quart; driers one gallon. First mix the oil and umber, preferably by grinding, though it may be hand-mixed. Then add the furniture varnish and driers, and mix all together; then strain it.

Oak Varnish Stain.—Use raw Italian sienna in place of the umber, with above formula.

Cherry Varnish Stain.—Use burnt Italian sienna and follow the first formula as to the rest.

Ebony Varnish Stain.—Use ivory drop black, or Nigrosine B Black, and liquids as given in the first formula.

Satinwood Varnish Stain.—Dissolve one pound of gum shellac, eight ounces of rosin, two ounces of gum benzoin, and two ounces of glue in one-half gallon of alcohol; add afterwards eight ounces of turmeric, or sufficient aniline yellow to give desired yellow color. Strain before using, and apply with a soft camel hair brush.

Note.—All but the last of these formulas are factory methods, slightly altered as to proportions, while the last, for satinwood, is an old one.

As previously stated, a varnish stain is simply a varnish to which some coloring material has been added; hence to secure any particular colored varnish all that is required is to select any of the various pigments, vegetable, mineral or chemical, and add it to the varnish. The vogue obtained for the much used colored varnishes that are household words owe their success entirely to the magic of big advertising.

Reade Publishing Co.
296 BROADWAY
NEW YORK, N. Y.